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A National Environmental/Energy Workforce Assessment. Minnesota

National Field Research Center, Inc, Iowa City, Iowa

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A National Environmental/Energy Workforce Assessment

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This study is one of 70 volumes assessing the workforce needs (manpower needs) for pollution control and abatement in the United States for the five-year period of 1976 through 1981. Seven fields for pollution control — air, noise, pesticides, potable water, radiation, solid waste, and wastewater — are analyzed, together with energy-related programs currently accentuated by the national effort to solve energy supply problems.

Designed as Phase I of a three-phase program, the complete assessment includes the following volumes: one each for the 50 states, the District of Columbia, Puerto Rico, and the Virgin Islands; one for each of the ten EPA regions; a one-volume National Abstract; a volume on National Legislation; a volume on Business and Industry; and a four-volume National Summary. The information was gathered through extensive personal interviews with responsible federal, state, and local officials in every state; with officials of representative private industrial and commercial firms; and with representatives of national industrial and trade organizations.

Phase II will develop a broad national inventory of the entire range of post-secondary and higher education training offered in the pollution control and energy areas cited above, and Phase III will offer demonstrations for curriculum changes or modifications which appear necessary to assure an adequate and properly trained national environmental/energy workforce.

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WORKFORCE ASSESSMENT

for

MINNESOTA

Conducted by:

NATIONAL FIELD RESEARCH CENTER, INC

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PREFACE

This study presents an analysis of existing workforce levels, training programs, and career potentials and develops staffing level projections (1976 to 1982) based on available information for the State of Minnesota in the environmental pollution control areas of air, noise, pesticides, potable water, radiation, solid waste, wastewater, and energy. This report is one portion of a study of the fifty states, Puerto Rico, and the Virgin Islands that was conducted by National Field Research Center, Inc. of Iowa City, Iowa.

The data presented in this report were compiled through comprehensive on-site interviews with professionals working in the public and private sectors. Supplementing this method were telephone surveys, mail contact, and research of the relevant literature. It should be pointed out that the data, where not documented by records, represents the best professional judgment of these experts.

Much of the introductory material included in the air, solid waste, and wastewater sections of this study was obtained from a report produced by the Minnesota Pollution Control Agency entitled, Minnesota Pollution Control Agency 1967-1976...and the Future. This excellent publication provides extensive information on the regulatory activities of the Minnesota Pollution Control Agency and an overview of the state situation with regard to these three pollution control areas. It also includes an explanation of the various state air, solid waste, and wastewater programs, a summary of state legislation applicable to the Agency, and an analysis

of current problems and future prospects. Research in the fifty states suggests that this document is unique. Because of its utility in acquainting readers with the state environmental situation, future concerns, and constraints to problem solving, the national abstract of this study includes the recommendation that other states produce similar publications.

FOREWORD

Information for this report was largely compiled from on-site interviews with professionals within Minnesota's state agencies with environmental protection functions and with professionals engaged in pollution control activities in the private sector. To strive for a higher degree of reliability, interviews were supplemented with telephone research. It should be noted that a large portion of the information contained herein represents the best professional judgments of those persons surveyed. The term "sources in the field" is used in this report to denote the pollution control professionals who provided information for the project. In cases in which more than one person provided input into a single program area, compilation of figures and recommendations was provided by the author. Much of the background material on agency programs, functions, and activities was obtained from program plans of the appropriate agencies.

This report provides information on the following eight pollution control fields: air, noise, pesticides, potable water, radiation, solid waste, wastewater and energy. In Section C of each chapter entitled, Workforce Projections, average per annum rates are derived by first calculating each year's growth rate for each category. The sum of these figures under each category is then found and is divided by the total number of years, i.e., by five.

Within the agencies and industries that were researched, compartmentalization of employees into the eight pollution control areas is not

necessarily a clear-cut situation. Functions occasionally overlap, inter-divisional cooperation occurs, and certain components serve a supporting role to an entire agency. Efforts were made in the preparation of this report to provide sufficient information for the reader to have an understanding of those segments of the workforce that play a major role in environmental protection activities and to provide divisions in a logical, realistic, and understandable manner.

National Environmental Energy Workforce Assessment

Phase I

MINNESOTA

State Summary

I. AIR

The Air Quality Division of the Minnesota Pollution Control Agency (MPCA) administers the state air pollution control program. Operations of the Division are carried out though the heaquarters located in Roseville and five regional offices. The Division's professional and technical staff currently totals thirty-eight persons. The staff is composed of engineers, scientists, and technicians. The Division anticipates a minimum of 5% per annum growth during the next five years.

Other state agencies providing support to the Division include the Attorney General's Office and the Minnesota Department of Health, Division of Environmental Health, Section of Analytical Services. A total of four person-years of assistance are provided. No increase in support is expected over the next five years.

There are three municipal air pollution control programs. The programs employ a total of six professional and technical persons. Positions include engineers, chemists, and inspectors. Staffing in these programs will remain stable through 1981.

Sources in the field estimate that there are up to 400 technical and professional persons employed in air pollution control activities in the private sector. This translates into 130 person-years of effort. Workforce requirements for the private sector are expected to grow by 5% per annum during the next five years.

II. NOISE

Primary responsibility for noise control is vested in the Noise Pollution Control Section of the Minnesota Pollution Control Agency (MPCA), Air Quality Division. The current professional staffing level of the Noise Pollution Control Section is two persons: one mechanical engineer who is a specialist in noise and an assistant. The Section has proposed to add four new positions in Fiscal Year 1978. They are an airport noise control specialist, a highway noise control specialist, a community programs and special studies person, and a technical services person. Sources at MPCA also indicated that there is a need for at least one noise specialist in each of the five regional offices to respond to complaints.

In the private sector most noise control work is concerned with designing quieter mechanical devices such as lawnmowers, mixers, and air conditioners. Sources were not able to provide estimates of the number of persons engaged in noise abatement activities in the private sector. The workforce in the private sector is expected to increase only minimally over the next five years.

Educational opportunities in the noise area are limited in Minnesota. Engineering departments of various colleges and universities offer some courses in noise control and conduct occasional noise control research. It appears that no vocational/technical institutions offer any noise control instruction that leads to a degree or certification.

III. PESTICIDES

The Minnesota Department of Agriculture, Agronomy Services Division, is the state lead agency for the operator certification and pesticide control program. Twenty-one staff members, including the sixteen-member field inspection staff, devote all or part of their time to the pesticide program. No growth is expected in the staffing requirements of the program during the next five years.

The Department of Agriculture, Laboratory Services Division, the Department of Natural Resources Laboratory, and the Department of Health, Section of Analytical Services devotes approximately seven professional person-years to pesticide laboratory analysis. No increase in staffing requirements is expected in the pesticide area during the next five years.

Also providing support to the Agronomy Services Division are the ninety-one county agricultural inspectors. The amount of time that the county agricultural inspectors devote to the pesticide program is dependent upon the nature of each county's economy. No growth is expected in the percentage of effort commitment over the next five years.

Sources in the field indicate that there are 1,880 commercial applicators and 18,000 farmers involved in pesticide activities. A decline is expected in the number of commercial applicators over the next five years.

IV. POTABLE WATER

The Minnesota Department of Health, Division of Environmental Health, Sections of Public Water Supply and General Environmental Engineering have regulatory responsibility for the potable water program. A total of nineteen professional and technical staff members are directly involved in the water supply program. The Section expects an average annual growth in staffing requirements of approximately 12% over the next five years.

The Minnesota Department of Health, Division of Environmental Health, Section of Analytical Services, has a staff of eighteen people working in water analysis. During the next five years, a total of eight to ten additional persons will be added to the staff. Further, sources in the field indicate that there are fifty municipal and thirty-five private laboratories which also conduct analysis of water supplies. Approximately 200 persons are currently employed in these laboratories, and it is projected that the staffing of the laboratories will grow by five to ten percent annually during the next five years.

There are approximately 1,095 certified treatment plant operators and an additional four hundred operators who were certified under the "grandfather" provisions. Sources also concluded that there are fifteen hundred non-certified operators in the state. A 5% per annum growth in demand for water treatment plant operators is expected through 1981.

V. RADIATION

The Minnesota Department of Health, Bureau of Environmental Health, Radiation Control Section has primary responsibility for radiation protection. The Radiation Control Section has a professional staff of nine members: director and eight inspectors. Sources at the Section expect the staff to increase by no more than two persons by 1982.

The Occupational Health Section of the Minnesota Department of Health, Bureau of Environmental Health is also involved in radiation protection. This section is responsible for enforcing radiation protection standards in industry. This Section has a staff of seven industrial hygiene engineers and three chemists. No additional staff will be added to the Section during the next five years.

Private sector data concerning numbers of individuals employed in radiation protection is not available at this time. There are seventy-three facilities using industrial X-ray devises in Minnesota. Each of these facilities is likely to have a safety officer, often an industrial hygienist, responsible for the proper use of the equipment. In addition, 1,038 hospitals and 361 clinics using medical diagnostic machines may have one person in each facility. The two nuclear power plants also employ safety staffs. Little growth in the private sector workforce is expected during the next five years.

VI. SOLID WASTE

Solid waste management regulation is the principal responsibility of the Minnesota Pollution Control Agency, the Division of Solid Waste. The current professional and technical staffing level for the Division of Solid Waste is twenty persons. Most staff professionals have background in engineering, geology, or science. The Division anticipates a 3% per annum growth in staffing through 1981, with growth primarily in the engineering and geology categories.

Laboratory support is provided by the Minnesota Department of Health, Division of Environmental Health, Section of Analytical Services. This Section devotes less than one person-year to the solid waste program.

Professional estimates concerning the private sector solid waste workforce indicate that a total of 2,831 persons are involved in municipal and private sector collection and disposal jobs. A total of 604 persons are currently employed at the 181 permitted solid waste disposal and processing facilities. In addition, 1,300 drivers and 1,350 jumpers are active in the collection field. During the next five years minimal growth is expected in either field.

Minnesota does not yet have any licensed resource recovery facilities in the state. Approximately 20 resource recovery/ energy conversion operations are in the design stage but will not be operational until at least 1982.

VII. WASTEWATER

The Minnesota Pollution Control Agency, Division of Water Quality is responsible for the administration of the state's wastewater pollution control program. The Division of Water Quality staff operates out of the headquarters in Roseville and five district offices. The Division has a professional and technical staff of 102 persons. A majority of the professionals have training as engineers, chemists, biologists, and planners. Eight of the positions are considered to be temporary. Minimal growth is expected during the coming five years. The eight temporary positions will be phased out, and only one new staff position will be added.

The Section of Analytical Services, Division of Environmental Health, Minnesota Department of Health provides laboratory support to the program. In this laboratory, eighteen persons work in water analysis. The Section may obtain an additional nine to ten professional staff members over the next five years.

There are 827 certified operators working in municipal, state, federal, private, and industrial wastewater treatment facilities, as well as 232 certified collection facility operators. Further, there may be up to 500 operators who are not certified, and another 300 persons working in such capacities as mechanic, laborer, chemist, laboratory technician, and clerk. Little growth is expected in the private sector wastewater pollution control workforce due to budgetary restrictions.

VIII. ENERGY

The Minnesota State Government has one principal energy agency, the Minnesota Energy Agency (MEA). The staff of the MEA is currently composed of forty-three professional and technical personnel. Major categories of employees include engineers, fuel allocation officers, research analysts, and planners. The MEA expects to experience a growth of approximately two positions per year over the next five years. Research scientists and engineers will be sought to fill these positions. Growth in this Agency is expected to continue as long as the federal government continues to pursue regulatory solutions to energy problems rather than market solutions.

Field research indicates that in the private sector most energy-related activities are conducted in the area of energy conservation. Most of the larger companies in the state have hired or are in the process of hiring an energy coordinator to perform such functions as supervising boiler operations, assessing long-term fuel supply, developing an energy conservation plan, and controlling pollution. Energy coordinators are likely to be engineers. There are also several engineering firms which specialize in performing energy audits for large corporations. There may be as many as six companies in the state whose activities are solely concerned with energy conservation, with a total of fifteen engineers employed full-time. Little growth is anticipated in the larger corporations; however, some growth may occur among consulting firms to assist private industry in solving energy problems.

STATE OF MINNESOTA - SUMMARY

National Environmental/Energy Workforce Assessment
Pollution Control & Abatement Personnel
Projected Workforce Requirements (1976-1981)

Environmental Area	1976	1977	1978	1979	1980	1981	%/annum growth (average)
AIR	178	188	198	208	218	228	5%
NOISE [1]	2	2	6	6	6	6	N/A
PESTICIDES [2]	19,880	19,880	19,880	19,880	19,880	19,880	N/A
POTABLE WATER [3]	3,233	3,398	3,564	3,730	3,897	4,064	5%
RADIATION [4]	10	10	10	10	10	10	0
SOLID WASTE	2,851	2,851	2,851	2,853	2,854	2,855	0
WASTEWATER	1,997	1,997	1,999	1,994	1,996	1,999	0
ENERGY [5]	43	43	45	47	49	51	4%
TOTALS	28,194	28,369	28,553	28,728	28,910	29,093	

[1] The above includes data on the public sector only.

[2] This estimate includes both private and public sector figures. Some decline is expected in the number of commercial operators, however no estimate of the percent decline was available.

[3] These figures are projections for both the public and private sectors; however workforce estimates were not available on the fifty municipal and thirty-five private laboratories.

[4] The above includes only state agency staff. No private sector projections are available.

[5] No private sector projection is included in the above estimate.

EDUCATION

A number of environmental education programs are available through Minnesota's educational institutions for persons interested in environmental pollution control careers. Bemidji State University offers A.S., B.S., and M.A. degrees in Environmental Studies. Emphases are available in laboratory, water, wastewater, soils, air, and solid waste. Winona State University also offers a B.S. degree in Biology with a major in Environmental Studies.

Short term courses are available through Mankato Area Vo-Tech Institute, Rochester Vo-Tech Institute, St. Cloud Area Vo-Tech Institute, and 916 Vo-Tech Institute in White Bear Lake. Programs offered through these Institutes include Civil Technology, Mankato; Chemical Laboratory Technician, Rochester; Water and Waste Treatment Technology, St. Cloud; and Environmental Technology Air and Water Analysis, White Bear Lake.

Austin Community College awards A.S. degrees in Environmental Technology. Programs provide students with training for employment in water, wastewater, and solid waste-related occupations. Other available two-year programs include Chemical Engineering Technology available through S.W. State University, Environmental Technology offered through Suburban Hennepin County Area Vo-Tech Institute, and Water Purification Technician provided at Vermillion Community College.

LEGISLATION

The environmental/energy legislation for Minnesota was obtained by request from various agency personnel and through various library references. Summaries of the legislation deemed most relevant to the eight subject areas of the workforce assessment were prepared, and are included in the respective state reports. The following list of laws represents virtually all environmental legislation for the state. Only certain of the following laws were summarized; the list is presented to show, by title, the kinds of laws which have been enacted.

Environmental Rights Act

Environmental Quality Board Law

Pollution Control Agency Law

State Environmental Policy Law

Pesticide Control Law of 1976

Solid Wastes Recycling Law

Water Pollution Control Act

Water Supply and Waste Water Treatment Facilities Law

Energy Agency Law

Critical Areas Act of 1973

National Environmental Energy Workforce Assessment

Phase I

MINNESOTA

State Report

STATE PROFILE

Minnesota, the North Star State, ranks fourteenth in land area and nineteenth in population of the fifty states. Providing vital rail and waterway links with the Gulf Coast and Atlantic ports, Minnesota dominates the northern midwest's transportation economy. The state's boundaries are formed by Lake Superior, Wisconsin, Iowa, the Dakota and Canada.

Reflecting this geographic region, Minnesota bears the scars of thousands of years of glacial action. Because it contains over 11,000 lakes, mineral deposits, important navigable waterways, and a range of soil types, the state's economy has been chiefly concerned with the exploitation of natural resources. Mining of high grade iron ore has declined due to the exhaustion of the rich Mesabi Range ore. Replacing this industry is the mining of low grade taconite ore which exists in huge quantities. Taconite mining has been the issue in recent litigation concerning asbestos pollution in Lake Superior. The issue is not yet resolved.

The geography of the state includes three separate regions whose economy reflects the nature of the land. In the northeastern region, mining and shipping provide many jobs. The huge stretches of coniferous forest once present in northeast Minnesota have been largely cut down. The central region of the state, once a broad belt of hardwood forest forty to eighty miles wide has been replaced with the cleared land and orderly dairy farm boundaries. Southwestern and

southern Minnesota are primarily devoted to corn, bean, and livestock production.

The major urban center lies in the Twin Cities region of St. Paul/ Minneapolis. The Twin Cities area is the country's fifteenth largest metropolitan area and is experiencing a rapid growth rate due to immigration from rural areas and the natural birth rate. Over one-half of the state's entire labor force is employed in the Twin Cities area. Manufacturing, service, and government-related jobs have combined to give this area its economic dominance over the state.

Employment in the areas of transportation, processing of natural resources, and manufacturing is declining somewhat in Minnesota as it is throughout the nation. More than twice the national average of job positions are in agriculturally related areas of the state's economy. Railroads also employ a significant portion of Minnesota's labor force.

Minnesota's natural resources do not include coal, oil, or natural gas at significant levels. The state exports many types of agricultural commodities and goods manufactured from natural resources such as paper, primary metals, and pulp products. The preponderance of manufacturing and the diversity of industries in the Twin Cities area has caused environmental concern over the quality of water, air, and solid waste disposal, as well as with noise pollution. The availability of Minnesota ports to seagoing shipping and barge traffic in the Great Lakes is a potential source of additional water pollution from spills and accidents.

MINNESOTA POLLUTION CONTROL AND ABATEMENT AGENCIES

Currently in its tenth year of operation, the Minnesota Pollution Control Agency is the principal state environmental agency. The Pollution Control Agency is responsible for the administration of the state air, noise, solid waste, and wastewater programs. The Department of Agriculture is the designated state lead agency for pesticide applicator certification and for pesticide pollution control, and the Department of Health has regulatory responsibility for the potable water and radiation programs.

The Minnesota Energy Agency, an independent agency within the executive branch, administers the state's energy policies and programs.

The Pollution Control Agency is headquartered in Roseville with regional offices in Duluth, Brainerd, Fergus Falls, Marshall, Rochester, and Roseville. The full-time professional, technical, and clerical staff of the Agency totals 245 persons. During the summer, about 25 additional persons--students and interns--also work for the Pollution Control Agency.

The Air Quality Division has a professional and technical staff of engineers, scientists, technicians, and planners whose activities include sampling, issuing installation permits, conducting plant inspections, recommending regulations, conducting an annual emissions inventory of major facilities, responding to complaints, and developing and maintaining a vehicle emissions and transportation control plan for the Twin Cities. In addition to its air quality management responsibilities, the Air Quality Division also is responsible for enforcing noise regulations. Because

the staffing of the Noise Pollution Control Section is limited to two people, enforcement activities occur only in response to complaints.

The priority programs of the Division of Solid Waste include source reduction, resource and energy recovery, hazardous waste management, sludge disposal management, and agricultural waste management. The Division has a professional and technical staff of 20 persons. The staff is comprised of engineers, geologists, technicians, biologists, and chemists who review permit applications for solid waste disposal facilities, close open dumps, inspect and monitor solid waste disposal facility operations, promote programs for the reduction, reuse and recycling of solid waste materials, and develop hazardous waste regulations.

Staffed by 102 professional and technical personnel with a wide variety of backgrounds, the Division of Water Quality administers the state's wastewater pollution control program. Activities of the Division of Water Quality include issuing permits under the NPDES program and permits for wastewater treatment facility construction, reviewing engineering plans for new treatment plants, inspecting plants to determine compliance with regulations, initiating enforcement action in cases of noncompliance, and coordinating a water quality management plan, as well as basin, segment and areawide plans.

Over the next ten years, the Pollution Control Agency is likely to be confronted with the following issues: identification and control of non-point source water pollution control, air quality anti-degradation, regulation of individual sewage treatment systems, environmental impact of copper-nickel mining, air quality impacts for the increased use of coal, source reduction, resource recovery, and energy recovery, ground

water protection, regulation of nuclear power, management of hazardous wastes, operation and maintenance of municipal wastewater treatment facilities, sludge disposal management, abatement of environmental noise, and management of new pollutants. The Pollution Control Agency will require significant staffing increases in all program areas to effectively deal with these imminent problems and issues.

Within the Department of Agriculture, the Agronomy Services Division is responsible for the applicator certification program. Thirty-one professional and technical staff members in the Division devote all or part of their time to the pesticide program. Also carrying out pesticide pollution control functions are the Department of Natural Resources, the Department of Health, and the Pollution Control Agency.

In the Department of Health, the Division of Environmental Health, Section of Public Water Supply has regulatory responsibility for the potable water program. The staff of the Section of Water Supply totals 10 engineers, sanitarians, technicians, and hydrologists who are responsible for adopting and reviewing standards, rules, and regulations for public water supplies, water well construction, fluoridation, and operator certification, reviewing plans for public water supply system construction, inspecting, investigating, and surveying public water supplies, and training and licensing water well contractors and water supply system operators. The state plans to accept primary enforcement responsibility for the Safe Drinking Water Act by the end of 1977.

The Radiation Control Section, Bureau of Environmental Health, Department of Health administers the radiation protection program with a professional staff of nine members. The Section conducts a registration

program for radiation sources and carries out limited environmental monitoring in the vicinity of the two nuclear power plants in the state.

Finally, the Minnesota Energy Agency was established in 1974 to administer the state's responsibilities under the Emergency Energy Allocation Act of 1973. The Agency is currently directed to collect energy supply and demand data, project future energy demand for the state, develop a comprehensive energy plan for the state, develop energy education programs, coordinate interdepartmental energy planning, and certify the need for new energy facilities. The Agency is staffed by 43 professional and technical personnel whose backgrounds range from many years of employment in gas companies to degreed planners, economists, physicists, chemists, environmental specialists, and mathematicians.

Pollution Control and Abatement Programs

I. AIR

A. Introduction

Minnesota has four major air pollution problems: particulates, sulfur dioxide, carbon monoxide, and photochemical oxidants. Since most point sources are meeting or will soon be meeting current particulate air pollution control regulations, state government officials believe the problem of high particulate concentrations result from fugitive dust carried from unpaved parking areas, unvegetated areas along roadways, unpaved rural roads, and some farming activities. High sulfur dioxide levels are a problem, particularly in urban areas and come primarily from power plants and refineries. Vehicle emissions cause excessive carbon monoxide levels in the central business districts of Minneapolis, St. Paul, Rochester, and Duluth. An emerging concern for Minnesota, as well as for the rest of the country, is pollution from photochemical oxidants. Since photochemical oxidants can come from hundreds or thousands of miles away, they will have to be regulated on a regional basis or by the federal government.

Responsibility for managing these problems lies with the Air Quality Division of the Minnesota Pollution Control Agency (MPCA). Established in 1968, the Division of Air Quality administers the state air pollution control program through five sections which include Technical Services, Engineering, Enforcement, Noise, and Transportation. Among the activities of the Division are the following:

1) Maintaining and upgrading the extensive network of continuous and discrete sampling analyzers located throughout the state;

2) Issuing installation permits for new emission facilities and for modification of existing facilities;

3) Conducting plant inspections and issuing operating permits;

4) Recommending air pollution control regulations;

5) Conducting an annual emissions inventory of facilities which emit more than 25 tons per year or have the potential to emit 100 tons or more of a pollutant;

6) Responding to air quality and noise complaints;

7) Coordinating, developing, monitoring, and maintaining vehicle emissions and transportation control strategies for the Twin Cities.

Since particulate and sulfur dioxide standards are being exceeded in many areas of the Twin Cities, a major goal of the Division of Air Quality is to attain air quality standards there. As a component of achieving this goal, the MPCA has developed a Metropolitan Transportation Plan for the Minneapolis/St. Paul Quality Control Region.

Under the Clean Air Act Amendments of 1970, EPA promulgated standards of performance for twelve new stationary sources which may contribute significantly to air pollution. The MPCA has adopted seven of the new source performance standards. Also under the Clean Air Act Amendments of 1970, EPA has promulgated standards for three hazardous pollutants, asbestos, beryllium, and mercury. The MPCA has adopted these standards as well.

The Division has begun to direct some effort toward the prevention of deterioration of present air quality. Through special surveys, it is attempting to identify specific problems which cause complaints or which cause high ambient pollution levels. However, because non-degradation decisions ultimately affect the type and amount of industrial growth that will occur in the state, this area is highly controversial and only limited work has been done so far. The issue of non-deterioration will receive increased attention by the Division in the future.

Augmenting the efforts of the Division of Air Quality are five relatively small municipal air pollution control programs. These programs are conducted in Bloomington, Minneapolis, Olmsted County, St. Louis County, and St. Cloud/Stearns County and are staffed by a total of eight professional and technical persons.

There are approximately 650 major sources in Minnesota which emit greater than 25 tons of pollutants annually and about 600 smaller emission sources. Included in these statistics in the private sector are the following industries: heat and power, chemical process (oil refineries, fertilizer, acid, and paper manufacturing plants), process (grain handling, asphalt mixing, taconite and wood processing plants), and metal processing (foundries and coke plants). These industries conduct the majority of private sector pollution control activity and employ the largest workforce in this area.

In the future, then, the Division of Air Quality will emphasize its enforcement program for bringing non-complying air pollution sources into compliance to enable the state to attain ambient air standards. Also of concern to the Division over the next several years

will be control of hazardous air pollution, a program which can be conducted with increasing effectiveness as the technology of monitoring low concentrations of hazardous substances improves. Finally, the state, the private sector, and the public will have a vital interest in decisions which are made regarding non-degradation because of the land-use implications of this issue.

B. Workforce Profile

Data for the workforce profile were obtained through on-site and telephone interviews with professionals in the field in the public and private sectors. Of particular assistance was Mr. Edward M. Wiik, Director, Air Quality Division, MPCA.

The operations of the Air Quality Division are carried out through the headquarters located in Roseville and five regional offices in Duluth, Brainerd, Fergus Falls, Marshall, and Rochester. The Division's professional and technical staff currently totals thirty-eight persons. The Division is composed primarily of engineers, scientists, and technicians, with the distribution of personnel among these positions as in the following table.

TABLE I

MINNESOTA POLLUTION CONTROL AGENCY

Air Quality Division
Current (1976) Staffing Level

Position	1976
Engineer	15
Scientist	15
Technician	4
Other	4
TOTAL	38

The engineers have degrees in mechanical, industrial, civil, chemical, electrical and agricultural engineering. Thirteen are registered professional engineers. Included in the "Scientist" category is a chemist, four research scientists who have degrees in the physical sciences, and ten pollution control specialists who are also degreed scientists. Also employed by the Division are three enforcement technicians and one electronics technician. The "Other" category includes the Division director, who is a registered professional engineer, two environmental planners, and a research analyst. Attorneys are assigned to the Division by the Attorney General's Office. In 1976, attorneys devoted about 1 1/3 person-years to the state air pollution control program. One full-time position is held by a federal assignee.

The Minnesota Department of Health, Division of Environmental Health, Section of Analytical Services, employs three chemists in air analysis. The municipal air pollution control programs in Bloomington and Minneapolis, Olmsted, St. Louis and St. Cloud/Stearns Counties employ a total of eight professional and technical personnel. Positions include engineers, chemists, and inspectors. In total, there are approximately 48 professional and technical personnel working in the public sector in air pollution control.

Sources in the field estimate that there may be a professional and technical workforce of over 400 persons in air pollution control in the private sector. It is estimated that there are between 30 and 40 consulting engineers throughout the state. In addition, there may be about 200 professionally trained persons and 200

technicians employed by the electric utilities, grain handling facilities, foundries, taconite plants, asphalt mixing plants, chemical plants, and refineries. The private sector professional workforce is composed primarily of engineers, with attorneys, chemists, meteorologists, and computer specialists also engaged in air pollution control activities. Technicians often have training and experience in electronics.

Activities are carried out by corporate environmental staffs, if corporate headquarters are located in Minnesota, and by plant engineering departments. Corporate environmental staffs are responsible for environmental policy planning, long-range planning of facilities and equipment, conducting environmental studies, preparing environmental reports for regulatory agencies, keeping top management informed of new rules and regulations, auditing plant performance as it relates to pollution control, and providing technical assistance to plants in solving air pollution problems. Engineering departments are responsible for ensuring plant compliance with air pollution control regulations, air quality monitoring, and operation and maintenance of air pollution control equipment. Often these departments are also responsible for interior plant conditions such as control of fumes and chemicals, in accordance with OSHA regulations.

Most of the professional and technical workforce does not devote full-time to air pollution control. Rather, these personnel may be involved in other environmental control activities, and frequently they perform other functions that are not related to environmental matters. If it is assumed that this workforce devotes 25% of its time

to air pollution control, a person-year approximation of effort devoted to air pollution control is 150 person-years of which 100 are professional and 50 technical.

Professionals in the field indicate that it is often more cost-effective for a company to hire outside consultants to solve a particular problem than for it to augment its permanent staff. While there may be between thirty and forty consulting engineers in the state, many corporations utilize the services of out-of-state consultants.

In filling professional positions in industry, companies tend to seek persons with experience in pollution control, who have a knowledge of environmental regulations and technology. Accordingly, recruitment is often conducted through advertisements in newspapers and professional journals, it may occur from within the company, or positions may be filled with persons recruited from governmental agencies. For technical positions, recruitment is often from within the company. This is primarily because of union regulations which require that members receive first consideration for job openings. Technicians who have electrical, mechanical or combustion backgrounds are favored.

In summary, approximately 480 professional and technical personnel are employed in the field of air pollution control in the public and private sectors. A person-year per year estimate of the time spent on air pollution control-related activities is 180. Nearly one-third of the air pollution control effort is conducted in the public sector, primarily by the Air Quality Division of MPCA and more than two-thirds

of the effort occurs in the private sector, either by industry or by consultants.

C. Workforce Projections

Workforce projections regarding the Air Quality Division are based on the best professional judgement of persons involved in the state air program. According to EPA estimates, the Minnesota Air Quality Division is understaffed by one-third; further, according to EPA the Minnesota program has the smallest state air pollution control staff in Region V. By 1982, the staff is expected to grow by ten persons. Workforce projections by position for the Air Quality Division are depicted in the following table.

TABLE II

MINNESOTA POLLUTION CONTROL AGENCY

Air Quality Division
Workforce Projections to 1982 (est.)

Position	1976	1977	1978	1979	1980	1981	%/annum turnover (average)	%/annum growth (average)
Engineer	15	15	15	15	15	15	5%	0
Scientist	15	15	15	15	15	15	5%	0
Technician	4	5	6	8	10	12	5%	25%
Other	4	5	6	6	6	6	5%	9%
TOTAL	38	40	42	44	46	48		5%

In aggregate, the Division's staff is expected to grow about 5% per year. The increase of two positions in the "Other" category will result from the addition of two planners. Eight air pollution technicians are also expected to be added to the Division's staff over the

next five years. Technicians will require skill in monitoring and instrumentation. As pointed out above, one position is held by a federal assignee, who receives two-year appointments. Six budgetary positions have been approved recently, to be paid through Federal Grant funds.

Sources at the Division anticipate that an expanded staff will be needed for increased monitoring and enforcement activities, as well as for working toward an air quality anti-degradation policy. Increased monitoring will be required for toxic pollutants, and expanded enforcement efforts will be necessary to bring non-complying sources into compliance. With regard to anti-degradation, all regions of the state are currently classified as Class II in which "moderate" levels of additional pollutants are allowed. The Division is conducting further analysis to determine whether areas should be reclassified as Class I, in which almost no change in air pollution is permitted or as Class III, in which pollution up to the level allowed by ambient standards is permitted.

The Section of Analytical Services of the Department of Health expects no growth in its air analysis staff over the next five years. The five local air pollution control programs in Bloomington and Minneapolis, and Olmsted, St. Louis and St. Cloud/Stearns Counties also expect no staff growth over the next five years.

Workforce projections regarding the private sector were obtained through on-site and telephone interviews with public and private

sector professionals engaged in air pollution control activities. These sources were asked to provide their best estimate of workforce projections for air pollution control.

The professional and technical workforce engaged in air pollution is expected to increase at a rate of between five and ten percent per year. Most companies developed their environmental staffs in the early 1970s, and most are now in compliance with air pollution standards. Of the 392 major installations, 355 are in compliance with emission limits or are following an acceptable compliance schedule. Sixteen major installations are in violation of current emission limits, and the status of 2 major installations is unknown. The air pollution problems of the grain handling and electric power industries are now under control. Problems still exist in taconite processing, asphalt paving, chemical plants, and refineries.

Thus, growth in the private sector will occur as a result of more stringent air pollution standards and state economic growth which may be accompanied by the building of new installations. Companies which are violating standards require updating of their equipment. Sources in the field indicate that most modifications will be minor and will not have much impact on the workforce. If, however, the energy shortage compels companies to increase their utilization of coal as a primary or secondary energy source, they may have to install sophisticated abatement equipment. It should be recalled that if a company is experiencing compliance problems or requires only short-term assistance, it will frequently hire a consultant rather than increase its own staff. Since out-of-state consultants

are frequently utilized, sources in the field expect the growth for Minnesota-based consultants to occur at a rate of about five percent per year.

Although specific turnover rates for the private sector are not available, field research suggests that turnover is low for both professional and technical positions.

The following table illustrates estimated growth rates to 1982 for professional, technical, and consulting positions. The table has been developed on the assumption that growth will proceed at an average annual rate of five percent. Numbers represent person-year equivalents.

TABLE III

STATE OF MINNESOTA

Private Sector Air Programs
Workforce Projections to 1982 (est.)

Position	1976	1977	1978	1979	1980	1981	%/annum growth (average)
Professional	50	53	56	59	62	65	5%
Technical	50	53	56	59	62	65	5%
Consultant	30	32	34	36	38	40	5%
TOTAL	130	138	146	154	162	170	5%

Table III shows that there may be an increase of about forty person-years devoted to air pollution control over the next five years or an increase of about eight person-years per year. This does not necessarily indicate that forty new jobs will be available since persons already working part-time in air pollution control may be given additional duties in this regard. It is clear, then, that workforce growth in the private sector in air pollution control will

be small over the next five years. Similarly, growth in the state air program is expected to be approximately five percent per year, an increase of about ten persons over the next five years.

D. Training and Certification

The MPCA conducts quarterly smoke schools for the recertification of smoke readers. Every six months a three-day training session is held which not only covers smoke reading but also provides other air pollution control instruction. Between fifty and sixty persons attend these sessions. Professional staff members of the Air Quality Division attend relevant EPA-sponsored courses whenever possible.

The University of Minnesota offers undergraduate and graduate training in public health and engineering which prepares graduates for entering the air pollution control field. Other universities, colleges, and community colleges in the state offer associate degrees in environmental technology and bachelor degrees in environmental studies which include air pollution control courses. Among these institutions are Bemidji State University, Mankato State University, and Austin Community College.

E. Career Potential

Field research suggests that workforce growth in both professional and technical level employment in the air pollution control field will be limited. An average annual growth rate of five percent is expected in the state air program and a five to ten percent annual rate of growth is projected for the private sector. Consequently,

career potential in this field will be restricted. In the state program, the growth that does occur is likely to be concentrated in the technician positions. Technicians can be increasingly utilized in the air pollution control field as some activities become more routine. In the private sector, growth will be predominantly for engineers and technicians. It should be noted that when technicians or engineers are required for air pollution control work, company employees frequently are selected and trained for the particular job. This is especially true for technician positions because of union regulations.

Because career opportunities in air pollution control are limited, sources in the field advise that vocational/technical schools and community colleges not establish programs designed specifically to train air pollution control technicians. Rather, they recommend that these institutions provide sound training in the basic technical skills such as instrument use, measurement taking, calibration, and error identification. Such curricula allow graduates not only to perform air pollution control activities competently and with a minimum of on-the-job training, but they also provide graduates with a technical background that can be applied to a variety of jobs.

F. Conclusion

The air pollution control field is staffed primarily by engineers, scientists and technicians, with growth in the field and career opportunities likely to be quite restricted over the next five years. The Air Quality Division of the MPCA expects to obtain about ten additional

positions over the next five years. Most of the projected staffing increase is for technicians. In the private sector growth may occur at a rate of five to ten percent per annum as a result of economic growth in the state and more stringent regulations. Most companies have by now developed and adequately staffed their environmental component.

In the public sector, efforts are expected to focus on enforcement, monitoring, planning, and non-deterioration. Issues of potential controversy that MPCA will have to address over the next five years include anti-degradation, the air pollution implications of mining the large reserves of copper and nickel discovered in the state, and the air quality impact of increased coal utilization which is expected as a result of oil and natural gas shortages. The MPCA has developed a transporation plan for the Minneapolis/St. Paul area but requires increased staffing to make the plan effective.

Sources at the Air Quality Division anticipate two problems in achieving an adequate staff. First, the rating methods used by the state civil service system make it difficult to obtain applicants with appropriate qualifications. Second, there is no assurance that federal appointees will have their positions converted to permanent staff status.

Field research suggests that it is not necessary for prospective employees to have specialized air pollution control training. At the degreed professional level a solid foundation in engineering or the physical sciences is recommended and at the technical level a good background in the use of instruments, taking measurements, and

calibration is recommended. Additional training needs can be effectively met through on-the-job training supplemented by selected semester and short upgrade courses sponsored by vocational/technical institutions, colleges, universities or EPA.

II. NOISE

A. Introduction

Primary responsibility for noise control is vested in the Noise Pollution Control Section of the Minnesota Pollution Control Agency (MPCA), Air Quality Division. The Noise Pollution Control Section was established in 1971 in response to numerous noise complaints and the mandate of the State Legislature but was not staffed until November, 1973. This Section is responsible for establishing and enforcing noise standards and regulations.

High priority functions for the Section are control of airport noise, especially at the Minneapolis/St. Paul International Airport and control of highway noise, particularly in metropolitan areas. MPCA has received many complaints of jet aircraft noise, and the Noise Pollution Control Section is conducting an intensive study of the problem. It is also involved in a highway noise abatement program with the Minnesota Department of Transportation. The Minnesota Department of Public Safety is responsible for enforcing state motor vehicle noise limits, with parallel efforts by local police and county sheriffs.

The MPCA has a noise/acoustics laboratory used primarily for the analysis of noise situations as they occur. This capability has been used for determining the impact of given sound levels in urban/suburban areas. Due to staffing and budget constraints this data accumulation and analysis component has not been consistently used to its full potential.

B. Workforce Profile

Data for the workforce profile was obtained through on-site and telephone interviews with professionals in the field. Ms. Susan Blomquist of the Noise Pollution Control Section, MPCA, provided valuable assistance in the collection of this data. The current professional staffing level of the Noise Pollution Control Section is one mechanical engineer who is a specialist in noise control and two part-time assistants. These staff members work in the central headquarters in Roseville. Sources at MPCA indicate that there is a need for at least one noise specialist in each of the five regional offices to respond to compliants.

Municipal noise control ordinances are enforced by local law enforcement authorities in response to complaints. The omission of acoustical criteria in the ordinances means that the regulations are nonquantitative and therefore difficult to enforce.

In the private sector most noise control work is concerned with designing quieter mechanical devices such as lawnmowers, mixers, and air conditioners. Sources in the field cannot provide estimates of the number of persons engaged in noise abatement activities in the private sector.

C. Workforce Projections

The Noise Pollution Control Section has proposed to add four new positions in Fiscal Year 1978. They are an airport noise control specialist, a highway noise control specialist, a community programs and

special studies person, and a technical services person. Beyond these four proposed additions, other growth in this area over the next five years is uncertain. Although specific academic backgrounds have not been outlined for these positions, it is expected that these four individuals will be college or university graduates.

Because environmental noise pollution control is just beginning to develop into a distinct professional area, the workforce in the private sector is expected to increase only minimally over the next five years.

D. Training and Certification

MPCA has offered compliance workshops to both the highway patrol and municipal enforcement personnel. These workshops include such topics as equipment usage and legislation and are one and one-half days in duration. Seventeen persons attended the workshop for the highway patrol and twenty-five persons were in attendance at the workshop for municipal enforcement personnel.

The engineering departments of the various colleges and universitites in the state offer some courses in noise control and conduct occasional noise control research. It appears that no vocational/technical institutions offer any noise control instruction that leads to a degree or certification.

E. Career Potential

Since the workforce in the area of noise pollution control is limited, there is little evidence that a significant number of career opportunities will develop over the next five years. Field research suggests that there is a need for acoustical engineering technicians to assist state planners in the construction, design and development of quieter urban areas and neighborhoods. Environmental engineers in industry may be assigned noise control duties. However, it is unlikely that many distinct careers in noise control will be developing.

F. Conclusion

Although there is an awareness by the MPCA of the need for control of environmental noise, the workforce engaged in this field is minimal. If public awareness or national policy does force the development of more noise control activities, there may be a need for trained scientists, engineers, planners, systems analysts, attorneys, and administrators, as well as for technicians. If significant development in this field should occur, upgrade/enrichment programs may be necessary for all involved personnel of all professions, and program development may be required, in particular for training in less than degreed technical areas where few training programs currently exist.

The present staffing level of the Noise Pollution Control Section of the MPCA is insufficient to accomplish current program needs.

The Section's ability to adequately develop additional noise regulations, monitor for violations of ambient noise standards, and develop an effective enforcement program to bring excessive noise levels throughout the state down to healthful levels will depend upon the availability of additional resources in the coming years.

III. PESTICIDES

A. Introduction

The Minnesota Pesticide Control Law of 1976 is Minnesota's primary pesticide law. It provides for licensing commercial and structural pesticide applicators and also for control of the application of restricted use pesticides by private applicators. While there is no licensing requirement for private applicators who utilize restricted use pesticides, dealers who sell or distribute such products must obtain a restricted use pesticide dealer license. These dealers must maintain a record of all purchasers of these pesticides. Those private applicators who purchase restricted use pesticides are then monitored in their utilization of the products.

The Minnesota Department of Agriculture is the state lead agency for the operator certification and pesticide control program. Within the Department of Agriculture, the Agronomy Services Division is responsible for carrying out the pesticides program. This Division administers laws and rules assigned to the Department for regulating the manufacture, distribution, sale, and use of pesticides, commercial feeds, fertilizers, antifreeze products, seeds, and related products.

The principal activities of the Agronomy Services Division with regard to pesticide control are licensing commercial and structural applicators, licensing dealers, monitoring pesticide applications, and investigating incidents. One hundred thirty pesticide incidents were investigated last year. Problem areas encountered by the

Division in the administration of the pesticides program include lack of advance knowledge of which pesticides will be restricted or banned, the large amount of paperwork generated by the program, and insufficient knowledge concerning the safety of new chemicals as they are placed on the market.

B. Workforce Profile

Information for the workforce profile was obtained through on-site and telephone interviews with professionals in the field. Mr. Gleason M. Diser, Director, Agronomy Services Division, Mr. Leo M. Lehn, Supervisor, Fertilizer and Economic Poisons Section, Agronomy Services Division and Mr. Randy Young, Agronomy Services Division, were especially helpful in the collection of this data.

The Agronomy Services Division has thirty-one professional and technical staff members. Staff members include a director, four supervisors, six seed analysts, sixteen field inspectors, two entomologists, and two pesticide control specialists. Twenty-one staff members, including the sixteen member field inspection staff, devote all or part of their time to the pesticide program. The backgrounds of the staff members are varied. They range from many years of practical experience in such occupations as farming, fertilizer manufacturing, and pesticide sales to degreed chemists, agronomists, and biologists. The two pesticide control specialists are degreed chemists. In the Agronomy Services Division about 40% of the staff members have degrees and about 60% do not.

The Department of Agriculture, Laboratory Services Division provides support for the pesticide program by conducting analyses of pesticide formulations and residues. Of the staff of nineteen professional and technical laboratory personnel two persons work in pesticide analysis. These two persons are degreed chemists. The Department of Natural Resources Laboratory and the Department of Health, Section of Analytical Services, also conduct pesticide analysis. Approximately five professional person-years are devoted to this area in these laboratories.

Also providing support to the Agronomy Services Division are ninety-one county agricultural inspectors. Each county in the state hires an agricultural inspector to perform a wide variety of tasks, always including control of weeds and seeds. While the Department of Agriculture has no jurisdiction over these inspectors, they do assist the field inspectors with surveillance of pesticide applicators. The amount of time that the county agricultural inspectors devote to the pesticides program is dependent upon the nature of each county's economy. That is, if a county is highly agricultural and has a large number of custom applicators, the county agricultural inspector may spend a substantial amount of time monitoring their applications. If a county is non-agricultural, a county inspector may contribute no time to the pesticides program.

Sources at the Department of Agriculture estimate that there are 1,300 commercial applicators and 180 structural applicators who may require certification to achieve the requirements of federal and

state legislation. Department officials estimate, further, that there may be an additional 400 crew members who will not be certified. Crews tend to range in size from one to 20 members, with an average size of four members. It is estimated that between 400 and 500 state employees who apply pesticides to government property will also require certification. There are approximately 18,000 farmers of whom some may apply restricted use pesticides. Private applicators, however, do not require licensing to apply such pesticides.

The total estimated pest control picture is reflected by the following table in which figures are approximations of the workforce engaged in pesticide application or control on either a full- or part-time basis.

TABLE IV

MINNESOTA PESTICIDES

Public and Private Sectors
Current (1976) Staffing Level (est.)

Public Sector		1976
Department of Agriculture		23
Department of Natural Resources/ Department of Health/Other State Agencies		500
County Agricultural Inspectors		91
	TOTAL	614
Private Sector		
Farmers		18,000
Owners/Operators/Applicators		1,880
	TOTAL	19,880

It should be noted that although there are approximately 18,000 farmers in Minnesota, not all of them will apply restricted use pesticides. In sum, then, there are over 600 public sector professional and technical personnel involved in pesticide usage and pest control practices. Their activities include inspection, enforcement, application, advising, and laboratory analysis. In the private sector, there are 1,480 commercial and structural applicators and about 400 crew members. A portion of the 18,000 farmers will apply restricted use pesticides.

C. Workforce Projections

Workforce projections are based on the best professional judgement of sources in the field. Division of Agronomy sources indicate that although the Division could use about five more staff members to meet the increased work load to satisfy EPA requirements, they do not expect an increase in the staff over the next five years. This is because the state legislature is not likely to appropriate sufficient funds for additional positions. Turnover for the Division staff is low, less than 3% per year. Sources at the Division indicate that the low turnover rate results from good working conditions and salaries which are competitive with those of the private sector. In addition, new entrants tend to be middle-aged and, therefore, less likely to change jobs. Most turnover is due to retirement.

The Laboratory Services Division of the Department of Agriculture expects to allocate five to ten percent more people to pesticide

analysis over the next five years. Chemists who are already working in the laboratory in other positions will be trained and transferred to pesticide analysis. Therefore, no net increase in staffing is expected. Growth in the amount of pesticide work to be conducted is the result of increasing complaints of improper application for which samples must be analyzed. Routine monitoring activities are projected to remain fairly constant.

Sources in the field indicate that in the next several years there will be a net decline in the number of persons employed in commercial application of pesticides. Contributing to this decrease is the financial responsibility provision of the Minnesota Pesticide Control Law of 1976. Under this provision, commercial and structural pesticide applicators must furnish proof of net assets equal to or greater than $50,000 or must purchase a performance bond or insurance to cover their pest control activities. Also contributing to the expected decline is the certification requirement for commercial and structural applicators.

In previous years the turnover rate for commercial applicators has been between twenty and thirty percent annually, but applicators who left the field tended to be replaced by other applicators. With the advent of financial responsibility and certification requirements, sources in the field anticipate that much of the turnover will not be replaced. Some of the larger companies, though, may expand somewhat to compensate for the reduction. Field research indicates that the larger companies will not be able to fully compensate for the attrition of commercial applicators. Thus, an unanticipated consequence of these

requirements may be to promote the monopolization of the commercial applicator industry in Minnesota. Moreover, a reduced workforce in commercial applications and increased monopolization of the industry could lead to higher prices for the service, at least on a temporary basis.

After the initial market adjustments to the financial responsibility and certification requirements occur, the decline in the workforce should level off and the workforce may, in fact, increase. Growth beyond current workforce levels ultimately will be dependent on whether there is a demand for commercial applicators to take over for private applicators.

Turnover rates among members of commercial applicator crews are reported to be extremely high. The average annual rate of turnover may be about thirty percent per year. The high turnover rate results from the seasonal nature of the job and the comparatively low pay.

D. Training and Certification

Responsibility for training of commercial and structural applicators has been assumed by the University of Minnesota Extension Service. Training is based on the core manuals of EPA and is supplemented by additional materials to meet special needs in the state. In 1976, six two-day training sessions were held in different areas of the state. Approximately 2,500 commercial applicators have been trained so far.

Training is also provided by the Minnesota Certified Applicators Association. This is an organization for licensed custom applicators and has been in existence for three years. In the past two years the

Association conducted two training schools which provided instruction in the safe application of pesticides. These training schools were held in a different location in the state and were attended by about one hundred persons. In addition, the Association held a conference to demonstrate the use of new equipment. This conference was attended by approximately one hundred and fifty persons.

E. Career Potential

The above analysis suggests that career opportunities in the field of pesticides in Minnesota will be limited. No growth is projected for the state agency staffs involved in pesticide usage and control primarily because of the restricted availability of state funding. The number of commercial applicators may well decline in the next year or two because of the financial responsibility and certification requirements. Field research suggests, however, that integrated pest management will assume increasing importance over the next several years because of the increasingly stringent requirements governing the use of pesticides and growing public sentiment against the excessive use of chemical pest controls in agriculture. Accordingly, career opportunities may develop for persons with agricultural science backgrounds who can serve as integrated pest management consultants. In addition, there may be opportunities at the technical level for people with short course backgrounds.

F. Conclusion

Because of EPA requirements and increasing public awareness of the possible harmful effects of pesticides, the workload of the Agronomy Services Division is increasing considerably. Not only must it devote resources to operator and dealer certification and routine monitoring, but the number of complaints concerning pesticide misuse is increasing and must be investigated. Budgetary constraints, however, will prevent an increase in the staffing of the Division to deal with the increased workload. The Division will not license private applicators. Officials there indicate that the licensing and record keeping required of dealers of restricted use pesticides and subsequent monitoring of purchasers of these products provides sufficient control over private applicators. Division officials maintain that this is the most cost-effective and efficient method of controlling the use of restricted pesticides by private applicators.

Field research indicates that a significant consequence of both the commercial applicator licensing and financial responsibility requirements will be a decline in the number of commercial applicators operating in Minnesota over the next several years. Because some of the smaller applicators may find it difficult to obtain a license and because some cannot afford to purchase the requisite bond or insurance, many are expected to leave the business and not be replaced, at least for several years. While some of the larger commercial applicators will expand their operations to compensate for the attrition, it is unlikely that they can fully replace the number of applicators lost. Therefore, it appears that in the short-run, at least, there will be

increased monopolization of the industry and reduced employment, a situation which could lead to higher prices for the service. In the longer term, it is likely that the workforce may increase to the same level as before these requirements were effected. Further growth will be dependent primarily on whether there is a demand for commercial applicators to take over for private applicators.

Sources in the field do not yet know what the effect of the PEPS 5 program will be since there have not been any situations involving the use of a "recognized expert" so far. Sources do point out that there is a potential problem in that regulations are ambiguous concerning liability if a "recognized expert" provides faulty information which causes damage to people or to the environment. They further point out that under the definition of a "recognized expert", representatives of pesticide manufacturers and dealers are excluded. They argue that many of these representatives have a highly sophisticated knowledge of pesticide usage. The definition, consequently, eliminates a source of expert consultation.

Although integrated pest management is in a relatively early stage of development, the application of integrated pest management techniques is likely to become increasingly widespread as federal and state pesticide regulations become more stringent, as public awareness grows, and as additional integrated pest management research becomes available. Consequently, the demand for trained personnel is likely to develop, and both universities and vocational/technical institutions may find a market for graduates trained in integrated pest management.

IV. POTABLE WATER

A. Introduction

There are 11,300 public water supplies in Minnesota. One thousand three hundred are community water supplies of which approximately seven hundred are municipally owned, and ten thousand are non-community water supplies. Forty-seven of the community supplies use surface water sources and two hundred of the non-community supplies are surface water supplies. For the purpose of certifying operators, water supply systems are classified in accordance with a rating scale which is designed to measure the degree of hazard to public health, type of system, loading of the plant, and population affected. The rating system takes into account the following factors: water supply source, quality of water supply, unit treatment process, distribution storage capacity, number of wells and population affected. Those systems which rate the highest are classified as Class A systems with ratings decreasing progressively through Class B, Class C, and Class D systems.

The person in direct responsible charge of a water supply system must obtain certification at a class equal to or higher than the class of the system. All operators, however, are encouraged to become certified and to upgrade their class of certification.

Of the seven hundred municipally owned public water supply systems about one hundred fifty are located in a seven-county metropolitan area and about five hundred fifty are located in rural areas. The one hundred fifty plants which serve the metropolitan areas tend to be comparatively large and employ a diversified staffing complement which may

include a superintendent, shift operators, maintenance, and administrative personnel. The rural plants tend to be much smaller averaging about two employees per system. Of the community public water supplies, 75.4 percent serve populations of less than 1,000 people.

The state plans to accept primary enforcement responsibility for the Safe Drinking Water Act. Legislation to allow the state to comply with the requirements of the Act has been enacted. Sources in the field anticipate that primacy will be acquired by the end of 1977.

The Minnesota Department of Health, Division of Environmental Health, Section of Public Water Supply has regulatory responsibility for the potable water program. Its objective with regard to public water supplies as stated by the Section is: "To effectively control those physical, chemical, and biological forces of the environment which may adversely affect the health and safety of the people of Minnesota in the area of water supply and related services." The activities of this Section include the following:

1) Adopting and reviewing standards, rules, and regulations for public water supplies, water well construction, fluoridation, and operator certification;

2) Reviewing plans for public water supply system construction;

3) Inspecting, investigating, and surveying public water supplies;

4) Licensing and certification of water well contractors and water supply system operators;

5) Training water well contractors and water supply system operators.

The Section is also involved in developing a groundwater quality information system and collecting data on abandoned wells in cavernous limestone.

Standards for review and approval of plans and specifications for public water supply systems have been developed by the Section of Public Water Supply. Approximately five hundred plans for water supply system construction are received and reviewed annually. Approximately five hundred certification examinations are given to operators each year. About fifteen hundred operators are presently certified and must renew their certificates every three years. The Section provided a variety of training opportunities in Fiscal Year 1976 which were attended by 1,469 persons.

B. Workforce Profile

Information for the workforce profile was obtained through on-site and telephone interviews with professionals in the field of water supply. Of particular assistance in compiling the data were Mr. Gary Englund, Chief and Mr. Paul B. Johnson, Engineer, Section of Public Water Supply, Minnesota Department of Health.

The water supply program of the Section of Public Water Supply is carried out through the Department of Health headquarters in Minneapolis and eight field offices located throughout the state. A total of ten professional and technical staff members are directly involved in the water supply program. Supporting this staff is the

field office staff of thirty professional and technical personnel. This staff provides support not only for the Section of Water Supply but also for the Section of General Environmental Engineering and for the Hotel, Resort, and Restaurant Section. The distribution of staff of the Section of Public Water Supply by position is shown below.

TABLE V

MINNESOTA DEPARTMENT OF HEALTH

Section of Public Water Supply
Current (1977) Staffing Level

Position	1977
Engineer	5
Sanitarian	1
Other	4
TOTAL	10

The engineers are civil and sanitary engineers. All are degreed and several are registered professional engineers. The sanitarian is a degreed scientist. The "Other" category includes an attorney and two hydrologists. Also on staff is an additional hydrologist who has been hired on a temporary basis to develop a data base for the Section to be provided to the Minnesota Department of Natural Resources.

The Section of Public Water Supply has primary responsibility for the public water supply program. The Public Water Supply portion of the Section consists of five sanitary engineers, one sanitarian, three hydrologists, and one attorney. The eight field offices, which also provide support to the water supply program, are staffed by four engineers and twenty-six sanitarians.

Table VI illustrates the distribution of certified treatment plant operators by operator classification. As mentioned above, certification is mandatory for the person in responsible charge of a system, and all operators are encouraged to become certified. The mandatory certification program was initiated in 1971, although a voluntary certification program had been in operation for twenty-five years prior to 1971.

TABLE VI

MINNESOTA POTABLE WATER

Current (1976) Certified Water Treatment System Operators

Classification	1976
A	53
B	217
C	441
D	384
TOTAL	1,095

The A classification of certification has the most stringent education, experience, and examination requirements, and the D Classification has the least stringent requirements. To become certified as a Class A operator, a person must not only fulfill the education and experience requirements and pass a written examination, but he/she must also pass an oral examination conducted by the Council of Certification.

In addition to the 1,095 operators certified in Classes A, B, C, and D, approximately four hundred operators are certified under "grandfather" provisions. That is, operators who were not certified and were operating systems before the mandatory program went into effect were permitted to obtain a certificate without examination. If they wish to renew their certification after it expires, these operators will have to fulfill an education and training requirement under the mandatory program. In total, then, there are about fifteen hundred certified operators in the state. Sources in the state regulatory program estimate that there may be another fifteen hundred operators who work at the water supply systems but who are not certified. Thus, there are approximately three thousand municipal treatment plant operators of whom about half are certified.

The Minnesota Department of Health, Division of Environmental Health, Section of Analytical Services, has a staff of eighteen people working in water analysis. This staff is composed mainly of degreed chemists who devote part of their time to the water supply program and part of their time to other water and wastewater programs. Further, sources in the field indicate that there are fifty laboratories in the state which are approved to conduct analysis of water supplies. It is estimated that in total there are about two hundred persons involved in water analysis in the state. Approximately one hundred of these people are degreed chemists, bacteriologists, and biologists and about one hundred are laboratory technicians. Other water testing is

carried out by certified operators and their assistants. In total, there are over 3,200 water supply personnel in the State of Minnesota.

C. Workforce Projections

Workforce projections are based on the best professional judgement of persons working in the field of water supply. Information was obtained through on-site and telephone interviews.

Workforce projections for the Section of Public Water Supply are shown in Table VII.

TABLE VII

MINNESOTA DEPARTMENT OF HEALTH

Section of Public Water Supply
Workforce Projections to 1982 (est.)

Position	1976	1977	1978	1979	1980	1981	%/annum turnover (average)	%/annum growth (average)
Engineer	5	7	9	11	13	15	0	25%
Sanitarian	1	1	1	1	1	1	10%	0
Other	4	4	5	6	7	8	n/a	15%
TOTAL	10	12	15	18	21	24		19%

The twenty-five percent average per annum growth in the engineering staff represents the projected addition of two engineers per year to the Section. Overall, the Section is expected to grow at an average annual rate of nineteen percent over the next five years. Much of this growth will be to carry out the increased workload that will occur as as result of accepting primary enforcement responsibility for the Safe Drinking Water Act.

The field office staff of twenty-six will experience no growth over the next five years and, in fact, may decline. This is because of a program which is being developed to transfer some of the services which this staff now provides to communities to provide for themselves.

No turnover has occurred in the engineering positions for the past seven years. Sources at the Section indicate that the lack of turnover for engineers results from good working conditions, the challenging nature of the job, and salaries which are competitive with those of the private sector. The average turnover rate for sanitarians is ten percent per year. The principal cause of this turnover is the higher salaries offered in the private sector.

Sources at the Section indicate that over one hundred new treatment plant operators are hired each year at the municipal water supply systems and that they expect this number to increase to about one hundred fifty operators per year over the next five years. As the staff devoted to the water supply program at the Section of Public Water Supply increases, more time will be spent conducting field inspections and providing technical assistance. Consequently, regulations will be enforced more stringently, thereby necessitating the hiring of additional operational personnel at many of the systems. If one hundred fifty new operators are hired each year over the next five years, then the water supply treatment system operator workforce will increase by seven hundred fifty persons by 1982. This represents

an average per annum growth rate of five percent. The turnover rate among certified operators is about ten percent per year. This relatively high rate of turnover is due primarily to low salaries and limited opportunity for advancement in pay or position, especially at many of the smaller water supply systems.

Sources at the Section indicate that in the one hundred fifty water supply systems that serve metropolitan areas the number of certified operators may increase from between ten to twenty-five percent over the next five years. This projection includes both newly employed operators who become certified and operators who have already been working at a system who become certified. In the five hundred fifty rural systems, the number of certified operators is expected to increase at a rate of about five percent per year. Sources at the Section suggest that the growth rate for certified operators will be higher at the larger systems because these systems tend to adopt a more aggressive policy than the rural systems toward encouraging operators to obtain the training necessary for certification. In addition, the larger systems can better afford to provide operators with the requisite training and to reward their efforts with higher pay and promotions. Some of the smaller systems, in fact, do not provide their operators with sufficient training because they lack the funds to finance transportation to and tuition for training sessions.

The Section of Analytical Services may obtain an additional nine or ten professional personnel in the water analysis program over the next five years. Part of this workforce increase will be devoted to potable water analysis and part to wastewater analysis. Because the private sector offers higher salaries than this laboratory, the laboratory experiences a problem of high turnover. Sources at the laboratory indicate that if often serves as a training ground for the private sector and that it is difficult, therefore, to maintain a highly competent state staff. Staffing at the other laboratories in the state is expected to increase at a rate of between five to ten percent per year primarily because of the increase in sampling activities necessitated by the Safe Drinking Water Act. If there is a staff of approximately two hundred at the municipal and private laboratories, this workforce will increase by between fifty and one hundred twenty persons over the next five years.

In summary, the regulatory staff for the water supply program will grow at a rate of about twelve percent per year or by about fifteen persons over the next five years mainly as a result of the increase in the workload when the state accepts primary enforcement responsibility for the Safe Drinking Water Act. The municipal water supply systems may acquire about seven hundred fifty new treatment plant operators by 1982, a growth rate of five percent per year. This growth will be brought about by more stringent enforcement of regulations by the state regulatory staff. Because the Safe Drinking

Water Act requires an increase in the amount of water sampling that must be carried out, the Section of Analytical Services staff may increase by up to ten persons, and municipal and private laboratory staffing may increase by five to ten percent, that is, by fifty to one hundred twenty persons.

D. Training and Certification

In Fiscal Year 1976, the staff of the Section of Public Water Supply provided twelve one-day schools for water supply system operators. These schools were attended by 771 operators. The staff also offered four three-day institutes which were attended by 502 operators. Finally, a traveling instructor provided water supply treatment courses in eight locations during the fiscal year which were attended by 196 persons. The course taught by the traveling instructor was sixteen weeks in duration and was offered one evening per week in each of the eight locations.

In Fiscal Year 1977, a sanitarian in the Section will begin to develop training materials designed for upgrade and advanced training. Through a variety of workshops and short courses to be offered around the state, the Section plans to train about two thousand operators per year. The American Water Works Assocation also provides training for operators who are already working in the field.

Various vocational/technical insitutions, community colleges, state colleges, and universities offer environmental curricula including

instruction in various aspects of potable water. Among them is St. Cloud Area Vocational/Technical Institute which offers an A.A.S. degree in water and wastewater treatment technology. This two-year program graduates between fifteen and twenty-two students annually. Of about twenty students who graduated from this program last year, four have found jobs at water supply systems. The majority of graduates are employed in wastewater treatment since employment opportunities in this area have expanded more rapidly.

Austin Community College, Bemidji State University, Rochester Vocational/Technical Institute, Vermillion Community College, 916 Vocational/Technical Institute (St. Paul), and Winona State University also provide a variety of training programs which include instruction on various water supply topics as part of two- and four-year environmental studies programs and laboratory technician training programs. The University of Minnesota provides education in water supply at both the bachelor and advanced degree levels through its various engineering, science, and public health programs.

Field research suggests that a variety of training needs and problems exist for water supply system operators in Minnesota. First, and perhaps most importantly, many of the smaller utilities cannot afford the expense of travel and tuition to training courses. Consequently, many operators of the smaller utilities are running the systems with insufficient background and training. Second, for the state regulatory program, providing effective training materials has been a problem insofar as it has been difficult to find or develop materials

with the proper balance of theoretical and practical content. Third, sources at the municipal water supply systems point out that there is a need for home study courses which can be correlated with the instruction provided by the state water supply personnel and by the American Water Works Association. Fourth, sources at the municipal water supplies also point out that the short courses which are available often are not intensive or extensive enough and that longer, in-depth courses would, in some cases, be preferable. Fifth, field sources indicate that there is a need for more training in the operation of distribution systems.

E. Career Potential

The foregoing suggests that career potential exists in all phases of potable water control. The state regulatory staff is expected to grow because of the increased activities necessitated by the Safe Drinking Water Act, and state laboratory operations will also expand for this reason. This growth may afford up to twenty-five new positions for trained engineers, sanitarians, chemists, and laboratory technicians. Similarly, at the private and municipal laboratories some growth is expected to result providing career opportunities for trained chemists, bacteriologists, biologists, and laboratory technicians. The number of new municipal water treatment plant operators may be between one hundred and one hundred fifty per year over the next five years. Moreover, the turnover rate of ten percent indicates that

there are continual openings for new operators. However, this turnover rate also indicates that there may be undesirable aspects to this job. Probably the factors contributing most to the high turnover are the low salaries and limited opportunities for advancement at many of the smaller utilities. Moreover, in some cases, poor working conditions may cause turnover. In some of the smaller utilities treatment plant operators work not only at the water supply systems but also as general caretakers. At the larger utilities in metropolitan areas, in contrast, greater opportunity exists for upgrade in salary and position.

Field research suggests that many communities prefer to hire their own residents and, therefore, will often hire an untrained resident in preference to a qualified graduate of a water treatment technology program. Some communities, however, specifically seek graduates of training programs such as the one offered by St. Cloud Area Vocational/Technical Institution.

F. Conclusion

It appears that a slow but steady increase in the potable water workforce will occur as Minnesota accepts primary enforcement responsibility for the Safe Drinking Water Act and as the state regulatory staff enforces regulations more stringently. The staff of the Section of Public Water Supply is expected to grow from its present staffing level of ten to about twenty-four persons over the next

five years. Growth will occur in engineering and other positions. The Section of Analytical Services and other laboratories in the state also are expected to grow, the former by up to ten positions and the latter by fifty to one hundred twenty positions by 1982. Thus, workforce opportunities should be available for chemists, bacteriologists, biologists, and laboratory technicians. The potable water treatment system operator workforce is expected to increase by between one hundred and one hundred fifty persons per year over the next five years. State regulatory officials do not yet know whether the additional systems which come under their jurisdiction as a result of the new definition of a public water supply in the Safe Drinking Act will be required to hire additional personnel to comply with new rules and regulations. Operators of these systems are and will continue to be encouraged to obtain certification.

A serious problem for the state for which no solution has yet been found is that of ensuring adequate training for operators of rural water supply systems. As pointed out previously, many communities cannot afford to send their operators to training sessions. To exacerbate this problem, operators with no prior experience in the field are frequently hired and, consequently, require training to supplement skills acquired on-the-job. It should be emphasized that 75.4 percent of the community public water supply systems serve populations of less than one thousand people, and the communities in which these systems are located are those which can least afford to

provide their operators with sufficient training. Other needs with regard to operator training include a need for home study materials to supplement the short courses offered by the state public water supply staff and by the American Water Works Association and longer and more intensive upgrade and advanced course offerings.

Field research suggests that the water system operations curriculum at the St. Cloud Area Vocational/Technical Institute produces sufficient numbers of able graduates to meet the state's needs for entry-level operators. However, it appears that upgrade and advanced training opportunities require expansion, and the Section of Public Water Supply is addressing this need by developing various courses of this nature. Perhaps a useful supplement to this Section's effort would be the development of appropriate continuing education courses to be offered at the state's vocational/technical institutions and community colleges. This mode of training would help to promote the education of rural operators by making the courses more geographically accessible to them.

V. RADIATION

A. Introduction

The Minnesota Department of Health, Bureau of Environmental Health, Radiation Control Section has primary responsibility for radiation protection. This Section develops and enforces regulations to control sources of ionizing radiation and to control handling, storage, transportation, use and disposal of radioactive isotopes and fissionable materials within the state. The Section administers the registration program for diagnostic equipment, conducts periodic surveys of this equipment, carries out limited environmental monitoring in the vicinity of the state's two nuclear power plants, monitors waste shipments from the plants, implements contracts with federal agencies, and responds to public health emergencies or incidents involving radioactive materials.

The Occupational Health Section of the Minnesota Department of Health, Bureau of Environmental Health also is involved in radiation protection. This Section is responsible for enforcing radiation standards in industry, as well as for control of industrial standards with regard to air and noise. Finally, the Minnesota Pollution Control Agency (MPCA) conducts limited activities with regard to radiation contro These activities focus on nuclear power plants and include limited environmental monitoring, research of issues relating to licensing nuclear power plants, analyzing state and federal legislation relating to nuclear power plants to determine their adequacy

for Minnesota, and monitoring the transportation of radioactive effluents. Minnesota is not an NRC agreement state.

B. Workforce Profile

The Radiation Control Section has a professional staff of nine members to carry out the activities listed above. The staff is composed of the director and eight inspectors. Members have bachelor degrees in the physical or biological sciences and all have had education in the basics of ionizing radiation.

The Occupational Health Section has a staff of seven industrial hygiene engineers and three chemists assigned by the state health laboratory. This staff devotes part of its time to enforcing radiation control regulations in industry. One staff member, an engineer, works full-time on radiation control in the MPCA.

Private sector data concerning numbers of individuals employed in radiation protection is not available at this time. The number of facilities using industrial X-ray devices in Minnesota is seventy-three. Each of these facilities is likely to have a safety officer, often an industrial hygienist, responsible for the proper use of the equipment. In addition, 1,038 hospitals and 361 clinics using medical diagnostic machines may also have one person in each facility responsible for the equipment. These persons may be health physicists, although this may not be true in smaller clinics. The two nuclear power plants in Minnesota also employ a safety staff, many of whom are likely to be health physicists.

C. Workforce Projections

Sources at the Radiation Control Section expect the staff to increase by no more than two persons by 1982. Neither the Occupational Health Section nor the MPCA expects any growth in staff devoted to radiation control. The Occupational Health Section expects to experience little growth because of the lack of emphasis on occupational health in the state at the present time. The MPCA's authority in terms of radiation control is limited and is not expected to increase significantly.

No new nuclear power plants are being planned for the next five years, so there will be little growth in the workforce involved in radiation control in nuclear power plants. Research suggests that the field of nuclear medicine is likely to expand over the next five years, thus providing jobs for professionally trained health and nuclear physicists and health specialists to work as technicians.

D. Training and Certification

The staffs of the Radiation Control and Occupation Health Sections receive on-the-job training, and members attend occasional formal short courses sponsored by various universities throughout the country and by federal agencies such as the Nuclear Regulatory Commission and the Bureau of Radiological Health. Denver Grove Community College, located near St. Paul, offers an occupational health and safety course which is attended primarily by private sector employees and employers. Sources at the Department of Health indicate that training needs exist for radiation control personnel in communication skills and radiation instrumentation.

E. Career Potential

Career opportunities in radiation control and protection appear to be limited because of little growth in this area in either the public or private sector. The greatest area of career opportunity is likely to be in the medical applications field with jobs becoming available for professionally trained health physicists and nuclear physicists and for technically trained health specialists.

F. Conclusion

Control of radiation in the public sector is shared by the Department of Health, Radiation Control and Occupational Health Sections and by the MPCA. The majority of radiation protection activities in the public sector are conducted by Department of Health personnel. In total, in the public sector, about seventeen professionally trained staff members are involved in radiation control on either a full- or part-time basis. Industrial hygienists and health physicists are employed in the private sector in radiation control in nuclear power plants, industry, hospitals and clinics. However, accurate workforce estimates for the private sector are not available. Little workforce growth is expected in either the public or private sector, and career opportunities in this field, with the exception of careers in medical applications of radiation, appear to be limited.

VI. SOLID WASTE

A. Introduction

There was no real control over solid waste management in Minnesota prior to 1970. In 1967, the State Legislature placed authority for regulating the management of solid waste with the Minnesota Pollution Control Agency (MPCA). A state solid waste management plan was developed and approved by the MPCA and EPA, and in 1970 the Division of Solid Waste was formed within the MPCA. Before 1974 the major programs of this Division included closing open dumps, permitting sanitary landfills to replace dumps, permitting livestock feedlots, and directing the collection and transportation of abandoned motor vehicles to scrap metal processors. In 1974, the solid waste management program was expanded to include source reduction, resource recovery, and hazardous waste management. Currently, the Division issues permits not only for sanitary landfills and feedlots but also for solid waste transfer stations, demolition waste landfills, resource recovery facilities, and special waste landfills such as power plant fly ash disposal facilities.

The Division is organized into five sections: Systems Management, Enforcement, Resources Management, Hazardous Waste, and Agricultural Waste. The Systems Management Section reviews permit applications for solid waste disposal facilities and also reviews environmental impact statements. The Enforcement Section is responsible for closing open dumps and other illegal disposal facilities, ensuring implementation of each county's approved solid waste management plan, and inspecting and monitoring solid waste disposal facility operations.

The programs for the reduction, reuse and recycling of solid waste materials is administered by the Resource Management Section. The Hazardous Waste Section is responsible for developing hazardous waste regulations to cover the collection, transportation and disposal of hazardous wastes. This Section is also responsible for the technical and administrative review of the chemical waste land disposal demonstration project. Funded by a grant from EPA to the MPCA, this project is designed to demonstrate proper treatment, recovery, and land disposal of certain hazardous waste materials. The Agricultural Waste Section administers regulations which control wastes from livestock feedlots, poultry lots, and other animal lots.

Each county is required to submit a solid waste management plan to the MPCA for approval. The MPCA has placed increasing emphasis on regional solutions to solid waste management problems, an approach which requires close cooperation and coordination among individual county governments and between the MPCA and the county governments.

Since 1974, the MPCA has become heavily involved in resource recovery, source reduction, and hazardous waste management. As land for establishing sanitary landfills decreases in metropolitan areas, attention must be given to reducing the amount of solid waste generated and finding alternative disposal technologies. The MPCA, so far, has emphasized source reduction over resource recovery. Since research has shown that 65% of the municipal solid waste stream is composed of discarded packaging materials, the MPCA has developed regulations to reduce this form of waste.

While resource recovery facilities for the state are still in the planning stage, MPCA officials anticipate a major problem regarding the viability of such operations. That is, resource recovery operations require large volumes of solid waste for proper operation and to offset the high capital investment necessary for their development. There is no mechanism to guarantee that such facilities will obtain the requisite volume of solid waste to a given resource recovery facility, especially if it is less costly for a hauler to go to a sanitary landfill.

The objective of the MPCA with regard to hazardous waste management is to bring hazardous substances under a tight control program. Presently, much of the hazardous waste is discharged into sewers, disposed of illegally at landfills, or indiscriminantly dumped, thereby endangering surface and ground water. The MPCA has no control over the generators of hazardous materials and therefore has no way of ensuring that such wastes are disposed of in an environmentally safe manner. Moreover, there are few adequate hazardous waste disposal facilities in the state, and the few acceptable privately-owned facilities are reluctant to expand unless hazardous waste regulations are adopted or enforced. Hazardous wastes from Minnesota are often disposed of in Iowa, Wisconsin, and Illinois. The MPCA is now in the process of preparing regulations for the proper identification, classification, collection, storage, treatment, and disposal of hazardous wastes.

B. Workforce Profile

Data for the workforce profile was obtained through on-site and telephone interviews with professionals in the field. Of particular assistance were Mr. Robert A. Silvagni, Director, and Mr. Larry Kramer, Division of Solid Waste, MPCA.

The current professional and technical staffing level for the Division of Solid Waste is twenty persons. This staff operates from the central headquarters in Roseville. In addition, staff support is lent by personnel in five district MPCA offices located in Duluth, Brainerd, Fergus Falls, Marshall, and Rochester. The current staffing level, by position, is shown in Table VIII.

TABLE VIII

MINNESOTA POLLUTION CONTROL AGENCY

Division of Solid Waste
Current (1976) Staffing Level

Position	1976
Engineer	7
Geologist	2
Technician	5
Scientist	5
Other	1
TOTAL	20

The engineers are all degreed, five in civil engineering and two in chemical engineering. The geologists are also degreed. Some of the technicians hold degrees and some do not. The technician positions are federally funded and are, therefore, temporary. The scientists are degreed biologists and chemists, and the other category is composed of the Division director, who is also an engineer.

Laboratory support is provided by the Minnesota Department of Health, Division of Environmental Health, Section of Analytical Services. This Section devotes less than one person-year to the solid waste program.

As of 1976, Minnesota had 181 permitted solid waste disposal or processing facilities. One hundred thirty-five of these facilities handle municipal waste, ten are transfer stations, and 26 are demolition landfills or handle special waste such as fly ash. In addition, there are approximately 300 open dumps in the state. Nine hundred open dumps have been closed since 1971. Field research suggests that the 300 open dumps may be operational only several days each week. Accordingly, there may be a total of about 435 landfill owner/operators in the state at both the licensed and unlicensed facilities. An approximation of the staffing distribution in solid waste operations is shown in Table IX.

TABLE IX

STATE OF MINNESOTA

Municipal and Private Solid Waste Disposal Workforce
Current (1976) Staffing Level

Position	1976
Landfill Owner/Operator	435
Heavy Equipment Operator	150
Weighmaster	2
Mechanic	12
Spotter	5
TOTAL	604

Field research indicates that there are approximately 500 crews employed in collection in the metropolitan areas and approximately 600 crews in collection in the rural areas. If it is assumed that the average crew size in metropolitan areas is 2.5 persons, then there may be a workforce of about 1,250 in collection in the metropolitan areas. Of this workforce about 500 persons are drivers and about 750 persons are jumpers and helpers. If it is assumed that the average crew size in rural areas is two persons, then there may be a workforce of 1,200 persons in collection in the rural areas. Of this workforce about 600 persons are drivers and about 600 are helpers and jumpers. In addition, there are about 200 drivers who collect solid waste for salvage operations. In total, then, there may be a workforce of about 2,650 employed in collection in Minnesota of which 1,300 persons are drivers and about 1,350 are jumpers and helpers.

Minnesota has ten transfer stations throughout the state. Seven are in metropolitan areas and are staffed by between three and six people, and three are in rural areas and are staffed by two to three people. Thus, approximately 40 persons are employed at transfer stations.

Minnesota does not yet have any licensed resource recovery facilities in the state, although about 15 handicapped persons are employed to separate usable materials out of the municipal solid waste stream. Approximately 20 resource recovery/energy conversion operations are in the design stage but will not be operational until at least 1982.

The MPCA administers a Resource Recovery Grant-in-Aid program which provides grants for up to 50 percent of the total costs of eligible resource recovery projects. Table X illustrates the types of projects funded under this program in fiscal years 1975 and 1976. This table is reproduced from the publication entitled, Minnesota Pollution Control Agency, 1967-1976...and the Future.

In sum, it appears that a workforce of up to 3,435 persons is employed in solid waste management in the public and private sectors in Minnesota.

C. Workforce Projections

Workforce projections are based on the best professional estimates of sources in the field. Although sources at the Division of Solid Waste indicate that a staff growth of 10 to 15 persons over the next five years would be ideal for handling the increasing workload, they expect to have only about four new professional positions authorized by 1982. In the next two years this staff will experience no growth because of limited funding by the State Legislature, and the four additional positions are expected to be authorized in the subsequent three years. Estimated workforce projections, by position, are illustrated in Table XI.

TABLE X

GRANT-IN-AID PROGRAM

FY 75

Projects Funded on a Matching Basis

Grantee	Amount	Type of Project
Metropolitan Council	$ 50,000.00	Metropolitan Area-Wide Systems Planning
Region Nine Development Commission	20,000.00	Demonstration-Source Separation of Newsprint/Region-Wide Plan.
SE Area-Wide Planning Organization	2,454.33	Two-County Systems Planning
City of Minneapolis	22,136.00	Public Education
Minnesota Environmental Science Fndn.	10,210.00	Public Education
Hennepin County	100,000.00	Systems Planning-Energy Recovery
WLSSD	46,584.50	Urban-Wide Systems Planning
University of Minnesota	78,714.50	Agricultural Wastes Research
St. Cloud Area	20,000.00	Region-Wide Systems Planning
Olmsted County	34,625.00	Systems Planning
City of Mankato	35,000.00	Feasibility Study - Plastics Recovery
City of Fairmont	11,125.00	Feasibility Study & Systems Planning-Energy Region
Aitkin County	22,000.00	Rural Recovery-Transfer Station
Solid Waste Mangement System	196,245.00	" " " "
MICC	17,100.00	Hazardous Waste Recovery
Minn. Geographic Society	7,600.00	Public Education
Science Museum of Minnesota	10,319.10	Public Education
Region Ten Development Commission	5,000.00	Region-Wide System, Planning
Occupational Training Center	2,524.00	Feasibility for Recovery Facility
" " "	61,000.00	Hardware - Mobile Can Baler
TOTAL FY 75	$752,637.43	

TABLE X (cont.)

GRANT-IN-AID PROGRAM

FY 76

Projects Funded on a Matching Basis

Grantee	Amount	Title/Type of Project
Metropolitan Inter-County Council	$ 31,279.00	"The Development of a Metropolitan System of Resource Recovery for Urban Tree Wastes -- A Feasibility Analysis'
Metropolitan Council	49,000.00	"System Planning for Resource and Energy Recovery from Solid Waste (Second Phase)"
Western Lake Superior Sanitary District	45,078.50	"WLSSD Resource Recovery and Energy Conservation Plan Implementation"
Occupational Training Center, Inc.	74,331.00	"Recycling Research and Demonstration Project"
City of Fairmont	23,750.00	"Fairmont Regional Refuse Resource Recovery System -- Phase III"
University of Minnesota	58,932.00	"Energy Extraction From Biomass Wastes in Minnesota"
Owatonna Reclamation Center, Inc.	4,000.00	Can recycling project
Region Nine Development Commission	22,250.00	"Project Implementation - Greater Mankato Can Recovery Program"

TABLE XI

MINNESOTA POLLUTION CONTROL AGENCY

Division of Solid Waste
Workforce Projections to 1982 (est.)

Position	1976	1977	1978	1979	1980	1981	%/annum turnover (average)	%/annum growth (average)
Engineer	7	7	7	8	9	10	3%	8%
Geologist	2	2	2	3	3	3	n/a	10%
Technician	5	5	5	5	5	5	n/a	0
Scientist	5	5	5	5	5	5	5%	0
Other	1	1	1	1	1	1	n/a	0
TOTAL	20	20	20	22	23	24		3%

The four projected positions are expected to be for highly trained chemical engineers and a hydrogeologist. The additional staff will be required for such priority programs as hazardous waste management, source reduction, resource recovery, and land disposal of sludge. The average annual turnover among the engineering and scientific positions is three percent and five percent respectively. The relatively low turnover rate is due to salaries being competitive with those of the private sector. The technician positions are federally funded and are temporary. The MPCA is requesting that one of these positions be made permanent in the next biennium and that federal funding continue for the other four positions. If these positions cannot be continued, the Division will suffer a staffing decline, a situation which is not depicted in Table XI. While turnover rates are not available for technicians, sources at the Division indicate that turnover is quite high because these positions may be only temporary.

Division officials also indicate that if the federal Resource Conservation and Recovery Act of 1976 actually generates money for the Division, ten to fifteen additional persons may be added to the staff.

Workforce projections, by position, for solid waste collection and disposal are shown in Table XII:

TABLE XII

Minnesota Municipal and Private Sector Solid Waste Workforce Projections to 1982 (est.)

Collection	1976	1977	1978	1979	1980	1981	%/annum turnover (average)	%/annum growth (average)
Driver	1300	1300	1300	1300	1300	1300	n/a	0
Jumper/Helper	1350	1350	1350	1350	1350	1350	n/a	0
Disposal								
Weighmaster	2	2	2	2	2	2	n/a	0
Heavy Eq. Op.	150	150	150	150	150	150	n/a	0
Mechanic	12	12	12	12	12	12	n/a	0
Foreman	12	12	12	12	12	12	n/a	0
Spotter	5	5	5	5	5	5	n/a	0
TOTAL	2831	2831	2831	2831	2831	2831	n/a	0

No growth in the collection workforce is expected to occur over the next five years. While the number of people employed in collection in the rural areas is expected to increase, this workforce in the metropolitan areas is likely to experience a commensurate decrease. The decline in the urban collection workforce will be the result of changes in technology which allow vehicles to carry more solid waste and to operate with smaller crews. Source reduction efforts should also contribute to this workforce decline. Although specific rates

of turnover are not available, field research suggests that turnover may be as high as 30 percent because of the dirty and hazardous working conditions, low pay, and little opportunity for advancement.

Although open dumps continue to close down, no net increase in the number of sanitary landfills is expected. In fact, some metropolitan landfills will be closing as they reach full capacity. Thus, sources in the field indicate that any increase in staffing at the sanitary landfills to compensate for the increased volume of solid waste from closing open dumps will be offset by the closing of sanitary landfills which have reached full capacity.

Again, sources in the field could provide no specific estimates of turnover among the workforce employed in disposal, but they do report that turnover rates here are also extremely high for all positions except foremen. Field sources suggest that those landfills which can afford foremen value these employees and pay them well. However, the other positions--heavy equipment operator, weighmaster, spotter--are low paying, dirty, and offer few opportunities for advancement.

The environmental impact criteria for establishing a disposal operation are becoming increasingly stringent, and it is increasingly difficult, therefore, to secure a disposal permit from county governments and the MPCA. For this reason, Minnesota will experience a transition from land disposal of solid waste to incineration, a technology which recently has become economically feasible for solid waste disposal. Sources at the Division of Solid Waste anticipate that six incinerators for this purpose will be designed and constructed over the next five years and will be

operational in six to nine years. The workforce effect of this change is expected to be minimal in terms of the numbers of persons employed in disposal. However, there will be a decline in the workforce operating landfills as the incinerators are utilized, but the staffing of the incinerators is expected to be such that little net change in aggregate employment in solid waste disposal will result. Sources at the Division indicate that incineration will be used most frequently in metropolitan areas and that, accordingly, the staffing at metropolitan landfills may decrease by as much as 50 percent in the next six to ten years.

The number of transfer stations is projected to double from the present level of ten to twenty over the next five years. Staffing also is expected to double and may total about eighty persons.

As pointed out above, there are no licensed resource recovery operations in Minnesota at the present time. Approximately twenty such facilities are being planned, and some may begin operation by 1982. While it is premature to make specific workforce estimates, sources in the field indicate that most of these facilities will be assembly line type operations requiring mostly unskilled labor. In addition, some mechanical engineers, computer specialists, and business management specialists will be needed. Some of these facilities will be publicly owned and some privately owned.

In summary, workforce projections for the field of solid waste management show that little growth is expected to occur over the next

five years except in the area of resource recovery. The Division of Solid Waste expects to experience an increase of approximately four positions over the next five years, although 10 to 15 positions are desired. The workforce employed in solid waste collection will remain constant over the next five years as more capital intensive collection methods are introduced and as source reduction occurs. The workforce employed in disposal also will remain constant over the next five years because of increased mechanization and the closing of sanitary landfills which have reached capacity. In six to ten years, the workforce at sanitary landfills will decrease significantly as incineration is increasingly utilized. This decrease is expected to be offset by employment at the incinerators. About 20 resource recovery facilities are targeted for operation in the 1980s. They could require a substantial number of workers for both skilled and unskilled positions.

D. Training and Certification

The MPCA provides training in many phases of solid waste management through annual operator training seminars and regional seminars. The annual operator training seminar is one and one-half days in duration and is usually attended by about 200 persons who work in various capacities in collection and disposal of solid waste in the municipalities and in private industry. An annual seminar is also held in each of the five MPCA regions. It is one day in duration and

each one is attended by about 20 persons. Division of Solid Waste staff members, as well as outside experts conduct these training sessions.

Several community and state colleges offer some training in solid waste management. Among them is Austin Community College which offers an A.A.S. degree in environmental technology and Bemidji State University which offers A.A.S., B.S., and M.A. degrees in environmental studies. All these programs offer some courses in solid waste management. The University of Minnesota provides training in various aspects of solid waste management through its engineering, science, and public health departments.

Sources in the field indicate that despite these programs, adequate and comprehensive training in solid waste management at the professional level is seriously lacking in Minnesota. As a result, well-trained professionals in solid waste management, hazardous waste management, and resource recovery cannot be hired. Consequently, there is a definite need for training programs to be developed which will satisfy this need.

E. Career Potential

The foregoing suggests that career opportunities in the Division of Solid Waste and in collection and disposal of solid waste will be limited. The Division expects to increase its staff by only four professional positions in the next five years. In collection and

disposal, the workforce is expected to experience no growth. Although the extremely high rates of turnover in collection and disposal suggest that jobs are continually available in these positions, the poor working conditions, low pay, and restricted advancement opportunities make such jobs highly undesirable.

In the next six to ten years, six incinerators are expected to be operational for the disposal of municipal solid waste. Sources at the Division indicate that each incinerator will be staffed by a team of about ten persons, approximately one-third of whom will be professionally or technically trained. At least one degreed engineer will be required, as well as professional supervisory personnel and persons skilled in mechanical engineering and design. The remaining positions will be filled by unskilled workers who will have to be provided with some training in the operation of the facilities.

Perhaps the greatest area of career potential is in resource recovery. Although specific workforce projections are not available, the planned operation of 20 resource recovery facilities suggests that there will be career opportunities for professional and technical personnel and for many unskilled workers. Civil engineers, geologists, and hydrogeologists who have specialized knowledge in solid waste management and resource recovery may find opportunities in planning and designing resource recovery facilities. Much of the equipment presently used for resource recovery was originally designed for other purposes, and therefore, it is not always adequate for use in

resource recovery operations. Accordingly, highly trained engineers are needed for equipment design. Mechanics, electricians, supervisors, and administrators who are knowledgeable in solid waste management and resource recovery also will be in demand. It should be pointed out, however, that the majority of jobs are likely to be for unskilled workers to perform assembly line type operations. This type of job typically offers little opportunity for career advancement.

F. Conclusion

While it is difficult to predict what the impact of the Resource Conservation and Recovery Act will be on the state, officials at the Division of Solid Waste indicate that if money is forthcoming from the Act, up to 15 additional people will be hired. Currently, the Division is putting forth the maximum effort feasible in terms of resource recovery and hazardous waste management given the resources available to it. Sources at the Division acknowledge that their efforts in this regard are quite inadequate and that neglect of these problems constitutes a serious threat to the quality of the state's surface and ground waters and soils but that expansion of control activities is limited by severe resource constraints.

Priority programs for the Division for the next several years include source reduction, resource and energy recovery, hazardous waste management, sludge disposal management, and agricultural waste management. Because improper land application of sludges can cause environmental damage, the MPCA is developing a program for the control

of water treatment sludges, industrial waste sludges, incinerator ashes, and septic tank pumpage. Agricultural waste management efforts will be emphasized since an estimated 30-40,000 of the state's 100,000 feedlots pose a current or potential threat to surface and groundwater quality. As pointed out previously, the MPCA is preparing regulations for the proper handling of hazardous wastes and is administering a grant-in-aid program to encourage resource recovery.

Although the only area of projected growth in the field of solid waste management is in resource recovery operations, training needs exist in all phases of solid waste management. Field research suggests that landfill operators and managers often lack adequate knowledge of proper practices as landfill operations become more diversified and complex. As incinerators are increasingly utilized, training will be necessary for persons in all positions. Training and research is also needed in the handling of hazardous wastes. The anticipated growth in resource recovery activities will require professional and technical personnel, some of whom will need training in various aspects of resource recovery technology. Much of the training for professional positions is not available in the state and educational programs are required to meet this need. Vocational/technical institutions or community colleges may require additional program development and modification to provide much of the necessary technical level training in solid waste management.

VII. WASTEWATER

A. Introduction

There are approximately 490 municipal wastewater treatment facilities in Minnesota. Classification of the facilities is based on the degree of hazard to public health, type and loading of facility, and size of the population or population equivalent served. Treatment facilities are classified from A to D, with Class A generally being the largest and employing the most complex treatment methods and Class D generally being the smallest and employing the least complex treatment methods. In addition, systems of collection, pumping and conveyance which are distinctly separate in operation or maintenance from the wastewater treatment facilities are designated as Class S treatment facilities.

Operator certification was voluntary between 1952 and 1971. In 1971, the State Legislature authorized mandatory certification for wastewater treatment plant operators. Specifically, a person in direct responsible charge of a wastewater treatment facility must be certified at the class of the facility, but all operators are encouraged to become certified. Class A is the highest category of certification and Class D the lowest. Certified operators of collection systems hold a Class S license. As of July 1, 1976, there were 728 certified municipal treatment plant operators and 232 certified collection facility operators. Also as of that date, 99 state, federal, private, and industrial wastewater treatment facility operators were certified. The certification program for operators in

responsible charge of state and private facilities is mandatory, and the program is voluntary for operators of federal and industrial facilities.

The Minnesota Pollution Control Agency (MPCA), Division of Water Quality is responsible for the administration of the state's wastewater pollution control program. The Division is divided into five sections and has, in addition, a support unit which coordinates the processing of environmental impact statements and assists with data processing. The five sections are Permits, Facilities, Surface and Groundwater, Compliance, and Enforcement and Planning.

The Permits Section issues permits under the NPDES program and facilities permits for wastewater treatment facility construction. To date, over 1200 permits have been issued under NPDES. The Facilities Section provides technical review of engineering reports and plans submitted for municipal and industrial wastewater treatment plants. This Section also inspects treatment plants, determines compliance with the conditions of permits, and provides technical assistance to plant operators. Water quality and effluent standards and regulations are developed by the Surface and Groundwater Section. This Section conducts routine monitoring at 103 stations and conducts additional monitoring and water quality studies as needed. The Compliance and Enforcement Section monitors the performance of permittees to determine whether compliance exists and initiates enforcement action in cases of noncompliance. The Planning Section coordinates water quality management plans and develops an annual program plan, as well as basin, segment, and area wide plans.

As of March, 1976 more than 450 communities in the state were not providing adequate treatment of sewage and industrial waste. Over four percent of the industries in the state which have separate discharges also were not providing adequate treatment but were on schedules of complaince. MPCA officials estimate that $3.4 billion in construction of municipal facilities is needed to provide adequate treatment of domestic sewage and industrial wastewater discharged into municipal systems.

While the goal of the MPCA is to protect the state's water by ensuring the adequate treatment of all wastewater, the Agency has been confronted with several problems which tend to hinder progress toward that goal. One problem is that of bypass of the treatment system caused both by high water at treatment plants and overflow at combined sewer interceptors. The combined sewer problem is especially severe in the Twin Cities, and it is anticipated that the solution will be expensive and will take several years. Dredge and fill operations also cause water pollution problems. These operations are regulated by the Corps of Engineers, a group which is not required to obtain Minnesota water quality certification. The state has initiated court action to require the Corps to comply with Minnesota water quality regulations. Improperly installed septic tank systems have caused degradation of the groundwater by sewage. The MPCA is working with a Citizens Advisory Committee to develop statewide technical standards governing the location, construction, and use of these systems.

A further problem involves the increasing numbers of wastewater treatment facilities using land spreading of sewage sludge and

municipal and industrial systems using landfilling techniques for sewage sludge burial. To try to avoid ground or surface water pollution from these practices, MPCA has initiated a program to guide and control sludge application practices. It is developing guidelines for land application of water treatment sludges, industrial waste sludges, incinerator ashes, and septic tank pumpage.

Finally, many municipalities will be unable to carry out secondary treatment of effluents by the July 1, 1977 deadline. This is because the Construction Grants Program ties municipal construction to the availability of federal funds which have not been sufficient for this purpose. Moreover, because industry must comply more rigidly than the municipalities with the 1977 deadline, joint treatment between industries and the municipalities, often the most efficient method of meeting standards, is frequently not feasible.

B. Workforce Profile

Data for the workforce profile wereobtained through on-site and telephone interviews with professionals in the field. Of particular assistance were Mr. Barry Schade, Assistant Director, Division of Water Quality; Mr. Willard Sexauer, Supervisor, Operator Training Unit; and Ms. Linda Giesen, Operator Training Unit, Division of Water Quality, MPCA.

The Division of Water Quality staff operates out of the MPCA headquarters in Roseville and five district offices. The Division has a professional and technical staff of 102 persons. Table XIII illustrates the current staffing level by position.

TABLE XIII

MINNESOTA POLLUTION CONTROL AGENCY

Division of Water Quality
Current (1976) Staffing Level

Position	1976
Engineer	41
Chemist	3
Biologist	19
Technician	9
Other	30
TOTAL	102

The engineers include agricultural, chemical, civil, electrical, geologic, and sanitary engineers. Many are registered professional engineers. The biologists and chemists hold bachelor degrees at minimum and many of the technicians are graduates of vocational/technical institutions. The "Other" category includes persons with degrees in the following: geography, botany, zoology, geology, mathematics, water resources planning, planning, business administration, liberal arts, and graphic arts. Eight of the positions, primarily biologists and planners, are temporary and are projected to be from six months to two years in duration. Three of the temporary positions are for 208 area wide planning. Much recent staff growth has been for the administration of the Construction Grants Program.

The Section of Analytical Services, Division of Environmental Health, Minnesota Department of Health provides laboratory services to the MPCA. In this laboratory, eighteen persons work in water analysis. Most are degreed chemists and devote part of their time to water quality analysis and part-time to potable water analysis.

The following table illustrates the distribution of certified municipal treatment plant operators by classification. This information was obtained from the MPCA "Memorandum on Status of the Wastewater Treatment Facility Operator Certification Activities in Minnesota for Fiscal Year 1976", July 1, 1976.

TABLE XIV

Current (1976) Minnesota Certified Municipal Wastewater Treatment Plant Operators

Classification	1976
A	212
B	72
C	248
D	196
TOTAL	728

In addition, there are 232 certified collection facility operators, that is, operators holding Class S certifications. As pointed out above, operator certification was voluntary until 1971 when the State Legislature authorized a mandatory program. The "A" classification has the most stringent education and experience requirements and the "D" certification has the least. Statistics for certificates held by operators of state, federal, private and industrial wastewater treatment facilities are shown in Table XV. This information was also obtained from the MPCA memorandum cited above.

TABLE XV

Current (1976) Minnesota Certified State, Federal, Private, and Industrial Wastewater Treatment Plant Operators

Type of Facility	1976
Township	6
State	29
Federal	10
Nursing Home	4
Miscellaneous	25
Industrial	25
TOTAL	99

While certification for the person in responsible charge of state and private wastewater treatment facilities is mandatory, certification for operators of federal and industrial facilities is voluntary.

In summary, then, there are 827 certified operators working in municipal, state, federal, private, and industrial wastewater treatment facilities, as well as 232 certified collection facility operators. In addition, there may be up to 500 operators who are not certified working at treatment facilities and about 300 other persons working in such capacities as mechanic, laborer, chemist, laboratory technician, and clerk. In total, approximately 1800 professional, technical, and clerical personnel are employed at wastewater treatment facilities in Minnesota. In addition, a professional and technical workforce of about 120 is engaged in the state wastewater pollution control programs.

C. Workforce Projections

Workforce projections are based on the best professional judgement of sources in the field. The Division of Water Quality expects little change in its staffing level over the next five years. Sources at the Division anticipate that there may be an increase in the operator training group. Currently this staff consists of one chemist, two certified operators, one social scientist, and one technician. Over the next five years, an additional person may be added to the headquarters staff and one person may be placed in each of the five district offices. Offsetting these potential increases is the possibility that the eight temporary employees will not be given permanent staff positions when their employment expires.

The average annual turnover rate for engineers in the Division of Water Quality is ten percent. For other professional and technical positions the average annual turnover rate is about five percent. Much of the turnover results from persons finding jobs with private industry where salaries are often higher and with other governmental agencies.

The Section of Analytical Services may obtain an additional nine or ten professional personnel in the water analysis program over the next five years. Part of this workforce increase will be devoted to wastewater analysis and part to potable water analysis. Because the private sector offers higher salaries than this laboratory, the laboratory experiences a problem of high turnover. Sources at the laboratory indicate that it often serves as a training ground for the private sector and that it is difficult, therefore, to maintain a highly competent state staff.

Sources at the Division of Water Quality and in the private sector suggest that the municipal treatment systems are currently well-staffed especially with regard to certified operators and that future growth in this workforce will be limited. Contributing to the minimal growth expected in this workforce is the trend toward regionalization in which several small communities provide combined treatment facilities. Some sources at the municipal treatment facilities offer a contrary assessment of the future. They indicate that there may be substantial growth in the number of certified operators needed over the next five years mainly because of the large amount of federal funding being provided for constructing municipal treatment facilities. It should be cautioned, however, that the amount of construction is not a reliable indicator of future workforce growth. Unless the specific nature of the construction is known, it is difficult to determine whether new construction actually will require additional labor. Moreover, as the technology of treatment becomes more capital intensive, the amount of additional labor required to operate these systems decreases.

Regardless of future growth, a problem presently exists insofar as nearly 88 municipal wastewater treatment facilities do not have a properly certified operator in responsible charge of the system. Several of these facilities are under construction or construction has recently been completed, and a certified operator has not yet been employed. The majority of noncompliance, however, is the result of the nonrenewal of expired certification, and some is the result of the inability of small communities to afford to hire a certified operator.

Turnover of treatment plant operators is relatively high, at least ten percent per year. This is the result of low salaries, limited opportunities for advancement, and poor working conditions at some of the smaller utilities. At the smaller utilities, an employee may be required not only to operate a wastewater treatment system but also to work as general caretaker.

Since about forty percent of the state's private industries may not be in compliance with effluent regulations, substantial construction and modification of facilities will be necessary. As with the municipal systems, it is difficult to determine workforce implications of wastewater treatment facility construction. Sources in the field suggest, however, that up to 1979 growth will be relatively low, approximately five percent annually. After 1979, as regulations become more strictly enforced, workforce growth in the private sector may approach twenty percent per year. This growth is projected to include not only persons involved in the operation and maintenance of industrial wastewater treatment facilities but also trained laboratory personnel, research scientists, information analysts, and technical writers.

To summarize, little growth is expected in the public sector wastewater pollution control workforce because of budgetary restrictions on the state level. The question of growth in the municipal systems is controversial. However, it seems likely that growth will be minimal despite the substantial amount of construction that is anticipated. This is because the systems are generally well-staffed and because of the trend toward regionalization of systems. Field

research indicates that substantial growth in the number of persons employed in wastewater pollution control in the private sector will begin in about 1979 and may average about twenty percent annually.

D. Training and Certification

The Division of Water Quality has for many years been actively involved in training wastewater treatment plant operators and other system personnel. The training program first consisted of an annual institute attended by both beginning and experienced operators. Since this method could not provide extensive or intensive enough training, the Division developed a program in cooperation with the Minnesota Department of Education in which a traveling instructor was employed to provide training throughout the state through the use of a twenty-week course conducted one night per week for two and one-half hours. The course was entitled "Fundamentals of Wastewater Treatment." The traveling instructor also spent a limited amount of time with the trainees at their respective wastewater treatment facilities. Approximately 175 operators were trained annually through this system. Supplementing this training were additional programs developed by Division staff members.

The use of the traveling instructor has been discontinued, and the Division plans to offer the following training programs on an annual basis:

1) Wastewater Operators Institute: A three-day seminar for all levels of wastewater treatment personnel from beginning operator to utility superintendent. Workshops will include basic math and treatment processes, as well as highly technical and advanced treatment modifications and advancements.

2) Collection System Seminar: A three-day seminar designed for collection system operators for training in the proper operations and maintenance of a collection system.

3) Stabilization Pond Seminar: A four-day seminar devoted to discussion of the concepts of good pond operation and maintenance to be supplemented by field trips to pond sites for hands-on experience.

4) Activated Sludge Workshop: A four-day workshop for activated sludge operators to provide training in the type of treatment and best methods for operating their systems.

Despite this variety of course offerings, municipalities find that it is sometimes difficult to provide operators with adequate training because of the cost of sending them to these sessions. This is especially true for many of the smaller, rural systems which may, as a consequence, be operated by improperly trained personnel.

Various vocational/technical institutions, community colleges, state colleges, and universities offer environmental curricula including instruction in wastewater pollution control. Among them is St. Cloud Area Vocational/Technical Institute which offers an A.A.S. degree in water and wastewater treatment technology. This two-year program graduates between fifteen and twenty-two students annually, and over half usually find jobs in wastewater treatement system operations. Austin Community College, Bemidji State University,

Rochester Vocational/Technical Institute, Suburban Hennepin County Area Vocational/Technical Institute, Vermillion Community College, 916 Vocational/Technical Institute, and Winona State University also provide a variety of training programs in water pollution control as part of two- and four-year environmental studies programs and laboratory technician training programs. The University of Minnesota provides education in water pollution control at both the bachelor and advanced degree levels through its various engineering, science, and public health programs. The Minnesota Wastewater Operators Association and the Central States Water Pollution Control Association, Inc. also are involved in training and upgrading operators.

E. Career Potential

The foregoing suggests that career potential both in the state regulatory program and at the municipal wastewater treatment systems is limited. Because of the relatively high rate of operator turnover at the municipal systems, however, there appears to be a continual demand for entry level operators to fill the vacancies. Field research suggests that many communities prefer to hire their own residents and, accordingly, will often choose an untrained resident in preference to a qualified graduate of a wastewater treatment technology program. Once hired, an operator's opportunities for advancement in pay and position are often proscribed in the smaller systems because of their lack of funds, while opportunities for advancement in the larger systems are substantially better.

To comply with effluent standards, industries may upgrade their treatment systems and utilize additional operators and maintenance personnel, thus providing some job opportunities in the private sector. Field research indicates that industries often choose personnel for these positions from among their own employees and then either provide them with on-the-job training or send them to vocational/technical institutions or other training sources for appropriate instruction. Consequently, an expanded workforce in industry in wastewater treatment operations and maintenance does not necessarily mean that there will be a commensurate increase in the number of persons employed by industry. Moreover, additional persons who are hired to compensate for those workers who have been transferred into water treatment operations will often be assigned duties which are not related to environmental protection.

Field research does suggest that career opportunities will develop for trained laboratory personnel, research scientists, information analysts, and technical writers. Jobs for such persons are expected to become prevalent after 1979.

F. Conclusion

While growth in the workforce employed in the state regulatory program and in the municipalities is expected to be minimal, there may be substantial growth in the private sector beginning in 1979 as more stringent pollution control regulations are strictly enforced. Specifically, the private sector is expected to expand by about five percent per annum until 1979 when growth is then expected to increase to twenty percent per annum.

The MPCA is confronted by a variety of problems including water pollution caused by bypass of treatment systems, dredge and fill operations, septic tank systems, and land disposal of sewage sludge. In addition, varying policies toward the municipalities and industry concerning secondary treatment of effluents also contributes to regulatory difficulties. Increased attention will be directed toward preventing the degradation of water quality caused by non-point sources of pollution as directed by Section 208 of the Federal Water Pollution Control Act of 1972. MPCA will prepare a plan to control non-point source pollution and the governor must approve the plan by 1978.

Policies also will have to be developed to deal with water pollution when the copper-nickel reserves in Minnesota begin to be exploited. The political ramifications of preventing water, air, and noise pollution from mining these reserves will be complex, and policy development in this regard is likely to require a large expenditure of resources by the MPCA. Because the State Legislature is not expected to authorize money for increasing the staff of the Division of Water Quality, the Division's effectiveness in addressing these problems may be somewhat impaired.

Sources at the municipal treatment systems indicate that the most effective training was carried out through the use of the traveling instructor and that they would like to see this method re-instituted. Many communities simply cannot afford to send operators to training sessions if it entails travel and tuition expenses and loss of time from the job. Perhaps the most serious training need is for upgrade

training of operational personnel, Many enter the field with no prior training or experience and therefore require extensive training to supplement skills acquired on-the-job. In addition, all operators require training or experience to keep informed of changes in treatment technology and to improve their skills in general operation, maintenance, mathematics, laboratory procedures, reporting, and record keeping. Sources in the field indicate that, overall, the amount of training offered by the MPCA and state educational institutions is adequate to satisfy training needs but that more coordination among programs is desirable. Moreover, it is advisable that courses be offered at various locations around the state to afford geographic proximity to prospective trainees. If any educational institutions are considering implementing or expanding their environmental control programs, field sources encourage them to provide upgrade rather than entry level training.

VIII. ENERGY

A. Introduction

No coal, oil, or natural gas is produced in Minnesota, and the geologic characteristics of the state are such that it is highly unlikely that the discovery of such minerals will occur. Thus, all of the state's natural gas and petroleum must be imported, and the only short-run energy supplement in the state is that which can be obtained through conservation measures.

The Minnesota State Government has one principal energy agency, the Minnesota Energy Agency (MEA). This Agency was created in 1974 as an independent department within the executive branch. Its functions include the following:

1) Collecting energy supply and demand data;

2) Projecting future energy supply and demand for the state;

3) Analyzing the effect of the energy forecast on the state's economy;

4) Developing and implementing a comprehensive energy conservation program for the state, including updating state building codes and studying more efficient methods of energy usage in residential and commercial buildings and industrial processes;

5) Developing energy education programs;

6) Administering state responsibilities under the Emergency Allocation Act of 1973;

7) Coordinating interdepartmental energy planning;

8) Certifying the need for new energy facilities.

In addition, the Environmental Quality Council (EQC) conducts some energy-related functions. The EQC is composed of the heads of seven state agencies: agriculture, energy, health, highways, natural resources, pollution control, and state planning, as well as a representative of the governor's office and four citizens appointed by the governor. The overall objective of the EQC is to promote cooperation and coordination among state agencies on matters which significantly affect the environment. In terms of energy, the EQC's functions include facilitating intergovernmental cooperation, recommending legislation, and administering the power plant siting and transmission line routing process.

Other state agencies which are involved in energy conservation are the Department of Administration which plans the State Government's energy consumption, the Department of Public Services which regulates electric utility rates, the House Finance Agency which provides loans for energy improvements in housing, and the Community Services Agency which administers a home weatherization project.

B. Workforce Profile

Data for the workforce profile were gathered through on-site and telephone interviews with professionals in the energy field. Particularly appreciated is the assistance of Mr. Rudy Brynolfson, Assistant Director, Minnesota Energy Agency.

The staff of the MEA is composed of forty-three professional and technical personnel. The current staffing level, by position, is shown on the following page.

TABLE XVI

MINNESOTA ENERGY AGENCY

Current (1976) Staffing Level

Position	Number
Director	1
Engineer	9
Fuel Allocation Officer	4
Information Officer	1
Librarian	2
Library Technician	1
Planner	6
Research Analyst	17
Attorney	1
Systems Analyst	1
TOTAL	43

Many of the engineers have been employed by gas companies and have a background in heating, air conditioning, and insulation. The fuel allocation officers disburse data on fuel availability in the state. Most have general science backgrounds, and many hold science degrees. Most of the planners have degrees in planning. The research analysts have a variety of backgrounds including economics, physics, chemistry, environmental studies, and mathematics. Some have bachelor and master degrees, and many have Ph.D.s. The attorney is provided by the Attorney General's Office. As pointed out above, the EQC has twelve members. This Council has no supportive staff.

Field research indicates that in the private sector most energy-related activities are conducted in the area of energy conservation. Most of the larger companies in the state have hired or are in the

process of hiring an energy coordinator to perform such functions as supervising boiler operations, assessing long-term fuel supply, developing an energy conservation plan, and controlling pollution. The energy coordinator usually becomes a part of the company's energy procurement operation and probably has a small, if any, staff. Energy coordinators are likely to be engineers. There are also several engineering firms in the state which specialize in energy-related work. Their major activity is performing energy audits for large corporations. Sources in the field estimate that there may be about six companies whose activities are solely concerned with energy conservation. It is estimated that a total of approximately fifteen engineers are employed by these firms.

C. Workforce Projections

Workforce projections are based upon the best professional judgement of sources in the field. The MEA expects to experience a growth of approximately two positions per year over the next five years. Research scientists and engineers will be sought to fill these positions. Growth in this Agency is expected to continue as long as the federal government continues to pursue regulatory solutions to energy problems rather than market solutions. The former method promotes the availability of federal funds to the states. To date, turnover among the professional and technical staff of the MEA has been low.

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Once the larger corporations have secured an energy coordinator, little growth is expected in this workforce. Field research suggests, however, that new jobs may be generated in industry to coordinate energy conservation programs and to keep top management abreast of energy-related legislation and regulations. Growth also may occur among consulting engineers to assist private industry in solving energy problems, and scientists and engineers may become involved in research of alternative energy sources. Sources in the field were not able to provide specific estimates of expected workforce growth in these areas.

D. Training and Certification

The University of Minnesota and other state colleges and universities provide training for engineers, scientists, and architects. The MEA also provides public information on energy conservation. Field research suggests that there are no comprehensive education programs in the state in energy management.

E. Career Potential

Career opportunities may develop over the next several years for degreed and highly trained engineers, scientists, and architects in energy research, product design and development, building design, and energy management. Few career opportunities appear to be emerging for non-degreed vocational/technical personnel.

F. Conclusion

Presently, over forty persons work full-time in energy planning and conservation in the public sector, and there may be a slight increase in this workforce over the next five years. Career opportunities in energy in the public sector appear to be quite limited. Minnesota's energy dependency dictates that new sources be developed. As a result, there may be a growing demand for highly trained scientists, engineers, and architects. However, specific projections for this workforce cannot be made at the present time.

Selected Post Secondary Institutions With Formal Environmental Energy Programs

A variety of educational offerings are available from Minnesota institutions of higher education for persons wishing to pursue careers in environmental pollution control fields. A partial listing of institutions and the types of programs they offer are shown below. This information was obtained from a publication of the Minnesota Pollution Control Agency entitled, "Wastewater Treatment Operators are the Key Figures in Clean, Safe, Water."

TYPE OF EDUCATION PROGRAM	SPONSORING INSTITUTION	DURATION AND/OR DEGREE
Env. Technology Program (trains students for employment in water, wastewater, and/or solid waste.)	Austin Comm College	2 Years Associate Degree
Environmental Studies (emphasis on lab, water, wastewater, soils, air, solid waste)	Bemidji State Univ.	2 Years Assoc. of Science Degree
Environmental Studies (emphasis in lab, water, wastewater, soils, air, solid waste.)	Bemidji State Univ.	4 Years Bachelor of Science Degree
Environmental Studies (emphasis in lab, water, wastewater, soils, air, solid waste)	Bemidji State Univ.	At least 1 year Master of Arts Degree
Civil Technology (emphasis on soils, water, runoff, dikes, etc.)	Mankato Area Vo-Tech Institute	42 weeks
Chemical Laboratory Technician	Rochester Vo-Tech Institute	9 months
Water and Waste Treatment Technology	St. Cloud Area Vo-Tech Institute	18 months

TYPE OF EDUCATIONAL PROGRAM	SPONSORING INSTITUTION	DURATION AND/OR DEGREE
Chemical Engineering Technology	S.W. State Univ.	2 Years Assoc. Degree
Environmental Technology (emphasis on sampling, lab work, water, and wastewater)	Suburban Hennepin County Area Vo-Tech Institute	2 Years
Water Purification Technician (emphasis in lab procedures and wastewater technology)	Vermillion Community College	2 Years
Environmental Technology Air and Water Analysis (emphasis on sampling and air and water analysis)	916 Vo-Tech Institute White Bear Lake	18 months
Biology with a major in Environmental Studies	Winona State Univ.	4 Years Bachelor of Science Degree

The following information for the University of Minnesota and St. Cloud Area Vo-Tech Institute are included to provide an example of some of the elements and characteristics of programs offered by a senior institution and a vocational-technical institution.

SENIOR INSTITUTIONS

University of Minnesota
Minneapolis, Minnesota

Program: Environmental Health (M.P.H., M.S., Ph.D.)

Hours required for M.P.H.: Quarter - 44
M.S. : Quarter - 44
Ph.D. : Depends on background of the student
Program Inception: Not Available
Staff Size: Nineteen professionals (11 Ph.Ds., 1 M.D., 3 M.S., 2 M.P.H., 1 B.S.E., 1 B.A.)
Enrollment: 96 (full- and part-time)
Graduates (1976): 40-50 (est.)
Placement: Approximately 100%
Graduate Work: Not Available

Courses - Selected Listing

Introduction to Environmental Health
Topics in Environmental Biology
Environmental Microbiology
Topics in Air Pollution
Air Pollution Controls and Surveys
Air Analysis I and II
Occupational Safety
Topics in Radiological Health
Measurement and Application of Ionizing Radiation
Environmental Radioactivity
Low-Level Radioactivity Measurements
Public Health Aspects of Toxic Products
Agricultural Occupational Health
Environmental Toxicology
Topics in Food Sanitation
Topics in Institutional Environmental Health
Environmental Health and Safety in Health Care Facilities
Topics in Water Hygiene
Environmental Health Aspects of Water Supply
Environmental Health Aspects of Wastewater Systems
Radiation Dosimetry
Water Quality Investigation and Research Techniques
Water Quality Research

Program: Aerospace Engineering and Mechanics (B.S.E.), Environmental and Biological Systems option

Hours required for major: Quarter - 120 with at least 12 credit hours in environmentally related courses
Program Inception: Not Available
Staff Size: Not Available
Enrollment: 2-3 (est.)
Graduates: Not Available
Placement: Not Available
Graduate Work: Not Available

Courses - Selected Listing

Fundamentals of Acoustics
Intermediate Acoustics
Special Topics in Acoustics
Design Morphology with Applications
Thermal Environmental Engineering
Industrial Ventilation and Contamination
Environmental Engineering

Program: Environmental Design (B.E.D.)

Hours required for Major: Quarter - 192
Program Inception: Not Available
Staff Size: Eleven professors, seven associate professors, thirteen assistant professors
Enrollment: Not Available
Graduates (July, 1975 - June, 1976): 16
Placement: Not Available
Graduate Work: Not Available

Courses - Selected Listing

Environmental Design: Man and Environment
Environmental Design: Tools and Processes
Environmental Design: Implementation and Evaluation
History of Environmental Development: Architecture
History of Environmental Development: Planning
Environmental Management and Control
Integrated Design Systems
Planning: Theory and Methodology
Cityscape
Urban Form

Program: Agricultural Engineering (B.Ag.E.), Soil and Water Engineering and Waste Management Specialization

Hours required for major: Quarter - 56
Program Inception: Before 1945
Staff Size: Eight professionals
Enrollment: 18 (est.)
Graduates (1976): 5
Placement: Not Available
Graduate Work: 1

Courses - Selected Listing

Issues in the Environment
Hydrology, Water Control
Seminar: Current Topics in Water Resources
Rural Sanitation and Water Supply
Drainage and Irrigation
Erosion Control, Watershed Engineering
Environmental Control for Agricultural Production
Agricultural Waste Management
Agricultural Waste Engineering

COMMUNITY COLLEGES/TECHNICAL INSTITUTIONS

St. Cloud Area Vo-Tech Institute
St. Cloud, Minnesota

Program: Water and Waste Treatment Technology (A.A.S)

Hours required for major: Quarter - 100 (2 year program)
Program Inception: Not Available
Staff Size: Not Available
Enrollment: 15 to 22 students per year
Graduates (1976): 22
Placement: 18
Graduate Work (B.S., B.A): 3

Courses

Biology Communication
Chemistry, Graphing
Physics, Mechanics, Heat
Technical Math I
Water, Wastewater
Microbiology
Chemistry, Technical Reporting
Physics, Light, Electricity
Technical Math II
Hydraulics
Water Quality
Wastewater Quality
Water, Wastewater Controls
Water Purification
General Economics
Survey, Communication
Wastewater Treatment
Instrument/Controls
Contracts, Codes, Costs
Industrial, Governments

State Legislation

MINNESOTA GENERAL

TITLE:

Environmental Rights Act
Minnesota Statutes 952

PURPOSE:

To provide for the protection, preservation, and enhancement of air, water, land, and other natural resources within the state through citizen civil actions.

DEFINITIONS:

1. Person
2. Non-resident individual
3. Natural resources
4. Pollution
5. Family farm
6. Family farm corporation
7. Bona fide farmer corporation

ADMINISTERING AUTHORITY:

Citizens of the state

AUTHORIZATIONS:

To maintain civil actions for the protection of air, water, land, and other natural resources of the state;
To challenge any state agency environmental quality standard or regulation;
To provide for procedural guidelines for any such civil actions.

MINNESOTA GENERAL

TITLE:

Environmental Quality Board Law
Minnesota Statutes 116C

PURPOSE:

To provide for the coordination of environmental problems and responsibilities among state agencies, and to create an environmental quality board.

DEFINITIONS:

1. Board

ADMINISTERING AUTHORITY:

Environmental Quality Board
Citizens Advisory Committee

AUTHORIZATIONS:

To review environmental programs and regulations of state agencies;
To encourage local environmental cooperation;
To conduct annual conferences;
To gather public information on environmental problems and concerns;
To make annual reports to the governnor and legislature.

MINNESOTA GENERAL

TITLE:

Pollution Control Agency Law
Minnesota Statutes 116

PURPOSE:

To provide for the coordination of state action relating to water, air and land pollution, and to create a state pollution control agency.

DEFINITIONS:

1. Air contaminant
2. Air pollution
3. Emission
4. Emission facility
5. Air contaminant treatment facility
6. Potential air contaminant storage facility
7. Person
8. Land pollution
9. Solid waste
10. Noise
11. Noise pollution
12. Hazardous waste
13. Deputy director
14. Assistant director
15. Cleaning agent
16. Nutrient
17. Chemical water conditioner

ADMINISTERING AUTHORITY:

Pollution Control Agency

AUTHORIZATIONS:

To adopt air quality standards;
To issue regulations concerning solid waste collection and disposal;
To adopt noise level standards;
To identify and control hazardous wastes;

AUTHORIZATIONS (Cont'd):

To administer permit programs, as necessary, for air, solid waste, noise and hazardous waste matters;
To develop comprehensive pollution control plans;
To issue emergency orders under the act;
To control water cleaning agents and nutrients;
To classify solid waste facilities and provide personnel training.

PROHIBITED ACTS:

To construct or operate potential air contaminant facility without permit;
To violate any emergency orders;
To violate cleaning agent and water conditioner rules;
To use, possess, sell or manufacture PCB's or PCB products;
To violate any other act provisions.

PENALTIES:

General violation constitutes a misdemeanor.

MINNESOTA GENERAL

TITLE:

State Environmental Policy Law
Minnesota Statutes 116D

PURPOSE:

To declare a state environmental policy, and to prevent damage to the environment and biosphere.

DEFINITIONS:

1. Permits for natural resources development or management
2. Natural resources
3. Pollution impairment or destruction

ADMINISTERING AUTHORITY:

Environmental Quality Board
All State Agencies

AUTHORIZATIONS:

To guide future environmental actions a broad state environmental policy is set forth;
To evaluate policies and actions to determine consistency with state policy;
To develop environmental impact statements for proposed major actions and projects.

MINNESOTA PESTICIDES

TITLE:

Minnesota Pesticide Control Law of 1976
Minnesota Statutes 18A.21

PURPOSE:

To provide for the control of pesticides and their application through regulation of registrations, applicators and dealers.

DEFINITIONS:

1. Active ingredient
2. Administrator
3. Adulterated
4. Approved agency
5. Beneficial insects
6. Certified applicator
7. Commercial applicator
8. Commissioner
9. Device
10. Distribute
11. Environment
12. EPA
13. FIFRA
14. Imminent hazard
15. Ingredient statement
16. Label
17. Labeling
18. Land
19. Licensed pesticide dealer
20. Misbranded
21. Noncommercial applicator
22. Person
23. Pest
24. Pesticide
25. Plant regulator
26. Private applicator
27. Protect the environment
28. Registrant
29. Restricted use pesticide
30. Spraying or dusting operations for hire
31. Structural pest
32. Structural pest control
33. Structural pest control applicator
34. Under the direct supervision of a certified applicator
35. Unreasonable adverse effect on environment
36. Wildlife

ADMINISTERING AUTHORITY:

Department of Agriculture

AUTHORIZATIONS:

To administer the registration of all pesticides;
To issue experimental use permits;
To license restricted use pesticide dealers;
To issue commercial applicator licenses, noncommercial applicator licenses, and structural pest control applicator licenses;
To certify private applicators;
To enter and inspect property to enforce the act;
To issue stop-sale and removal orders;
To issue regulations pursuant to the act regarding pests, pesticide sampling and handling, pesticide labeling and packaging.

CERTIFICATION OR LICENSING:

All commercial, noncommercial, structural, and private applicators must meet license or certification requirements established by Commissioner. Classification of applicators are established; except for private applicators, examination may be required.

PROHIBITED ACTS:

To fail to register pesticides;
To sell restricted pesticides without a license;
To use restricted pesticides without proper license or certificate;
To store or dispose of pesticides or containers to harm environment.

EXEMPTIONS:

Limited sales by applicators; sales by public agencies; sales by physicians, veterinarians, pharmacists.

PENALTIES:

Violations are a misdemeanor.

MINNESOTA SOLID WASTE

TITLE:

Solid Wastes Recycling Law
Minnesota Statutes 116F

PURPOSE:

To reduce solid waste pollution and to encourage the reduction, re-use and recycling of solid waste.

DEFINITIONS:

1. Agency
2. Institution
3. Municipality
4. Region
5. Resource recovery system
6. Solid waste generation

ADMINISTERING AUTHORITY:

Pollution Control Agency

AUTHORIZATIONS:

To issue regulations pursuant to the act;
To develop a solid waste conservation program;
To encourage market development for reusable solid materials;
To conduct studies and investigations relating to solid waste;
To assist in development of resource recovery systems;
To enforce the act.

PROHIBITED ACTS:

To violate any regulations or provisions of the act.

PENALTIES:

Violations constitute a misdemeanor.

MINNESOTA WASTE WATER

TITLE:

Water Pollution Control Act
Minnesota Statutes 115.01

PURPOSE:

To provide a statewide program of water pollution abatement and control.

DEFINITIONS:

1. Sewage
2. Industrial waste
3. Other wastes
4. Pollution of water
5. Sewer system
6. Treatment works
7. Disposal system
8. Waters of the state
9. Person
10. Agency
11. Discharge
12. Pollutant
13. Toxic pollutants
14. Point source
15. Standards
16. Schedule of compliance

ADMINISTERING AUTHORITY:

Pollution Control Agency

AUTHORIZATIONS:

To enforce all water pollution laws;
To investigate water pollution in the state;
To establish water pollution standards;
To issue regulations pursuant to the act;
To establish treatment and new source performance standards;
To approve plans for disposal systems and point sources;
To act as the state lead agency in water pollution matters;
To administer the state pollutant discharge permit program.

PROHIBITED ACTS:

To permit industrial buildings without approved treatment facility;
To construct, operate or alter disposal system without permit;
To cause or allow water pollution in violation of standards;
To violate any other act provisions.

PENALTIES:

Criminal - violation constitutes a misdemeanor;
Pollutant discharge violation - fines of from $2,500 to $25,000 for willful violation;
Civil - fines of up to $10,000 per day.

MINNESOTA WASTE WATER

TITLE:

Water Supply and Waste Water Treatment Facilities Law
Minnesota Statutes 115.71

PURPOSE:

To provide for the protection of public health through water supply and waste water facility operator certification.

DEFINITIONS:

1. Secretary
2. Director
3. Board
4. Water certificate
5. Waste water certificate
6. Water supply system
7. Waste water treatment facility
8. Water supply system operator
9. Waste water treatment facility operator

ADMINISTERING AUTHORITY

Pollution Control Agency
State Board of Health
Board of Certification

AUTHORIZATIONS:

To classify all water supply and waste water facilities;
To certify operators of water supply and waste water facilities;
To issue regulations pursuant to the act.

CERTIFICATION OR LICENSING:

Water supply and waste water treatment operators must be tested as to competency and certified corresponding to facility; prior operators or those voluntarily certified are certified under law without examination.

PROHIBITED ACTS:

To operate a water supply or waste water treatment facility without certified operator;
To act as operator without proper certification.

MINNESOTA ENERGY

TITLE:

Energy Agency Law
Minnesota Statutes 116H

PURPOSE:

To encourage energy conservation and efficient utilization, and to provide for a state plan of energy planning and development.

DEFINITIONS:

1. Agency
2. Commission
3. Director
4. Large energy facility
5. Petroleum supplier
6. Coal supplier
7. Utility
8. Construction
9. Decorative gas lamp
10. Solar energy system

ADMINISTERING AUTHORITY:

Minnesota Energy Agency

AUTHORIZATIONS:

To collect state energy data;
To adopt an emergency allocation plan;
To carry out energy conservation measures;
To provide public education on energy matters;
To require certificate of need for all large energy facility construction;
To issue regulations pursuant to the act;
To report to the governor and legislature on energy matters;
To establish energy use standards;
To evaluate alternative energy resources for the state.

PROHIBITED ACTS:

To violate any conservation, use or other regulations.

PENALTIES:

Fines of up to $10,000.